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THIRD SERIES FOUNDED BY EDWARD JACKSON

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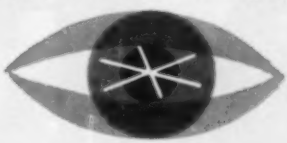

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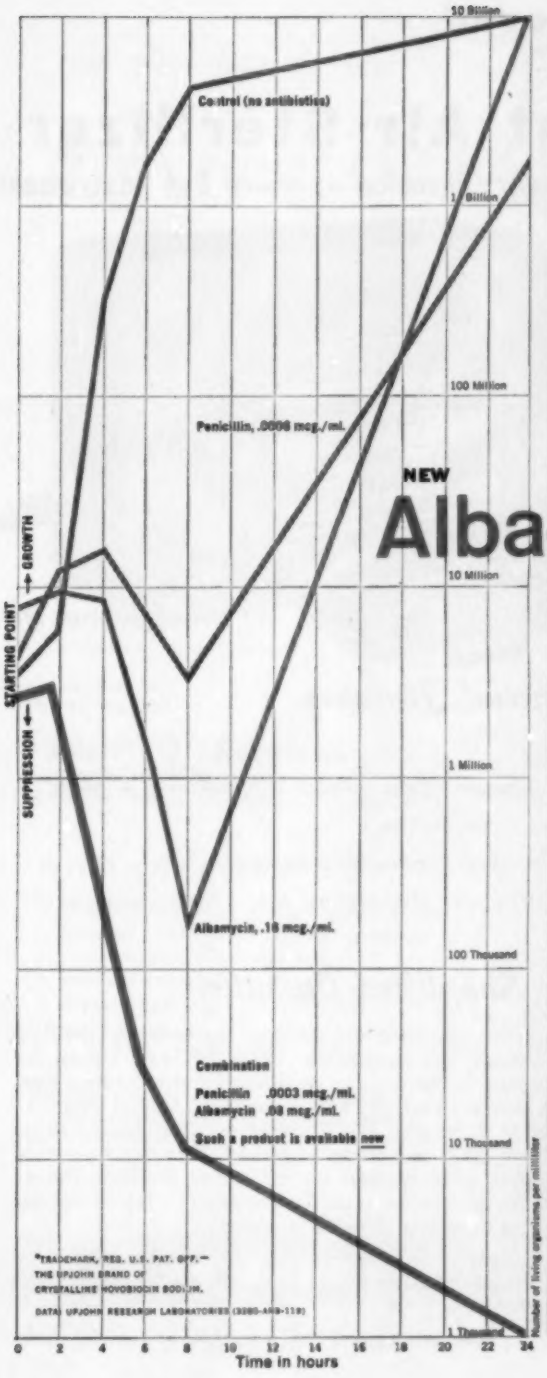

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Patients have often asked for more than one field—either a distance and reading telescopic or a normal distance field with either a distance or reading telescopic included. One manufacturer has designed telescopics for binocular distance vision with a central distance telescopic button. The periphery contains the patient's normal distance correction and enables him to retain proper distance perspective by the alternate use of central and peripheral fields. Several manufacturers are making lightweight telescopic spectacles with reading attachments.

Distance (plastic) lenses are being used with a strong aspheric magnifier in the lower portion of the lens. Such lens forms have been used in the past but the glass lens has the double disadvantage of additional weight and a serious reduction in field of any appreciably strong magnification due to the use of spherical surfaces. It should be noted that binocular vision cannot be successfully obtained in magnifications above 5X without the use of prisms. Therefore, the aspheric magnifications from 6X to 12X are for monocular use only.

A major fitting problem in all telescopic spectacles is their excessive weight. With the use of plastic lenses and lightweight plastic frames this problem will normally be obviated.

The majority of these lenses are new products and not all are as yet commercially available. However, the prototypes have been tested in various clinics and are in process of production. Mass-production methods of molding should keep their final price well within reach of the limited resources of elderly people who most often require these aids. It seems that no longer will you (and we) be forced to tell the majority of our patients with subnormal vision—"I'm sorry, but I can't help you."

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 43 JANUARY, 1957 NUMBER 1

FAILURE IN CONGENITAL CATARACT SURGERY*

A STUDY OF FIFTY-SIX ENUCLEATED EYES

THE XII EDWARD JACKSON MEMORIAL LECTURE

FREDERICK C. CORDES, M.D.
San Francisco, California

It is indeed an honor to have been asked to give the Edward Jackson Lecture. Dr. Jackson, who was born in 1856 and died in 1942, was one of the really great figures in ophthalmology. In 1888, he became professor of diseases of the eye at the Philadelphia Polyclinic Hospital, and in 1890 he was appointed surgeon at Wills Eye Hospital. Because of the poor health of his wife, he moved to Denver in 1894, and it was this move that introduced him to the Far West, where he was destined to play such an important part in ophthalmology. When Dr. John Weeks also established himself in the West, in Portland, he and Dr. Jackson kept in close touch with each other, and their warm, lively friendship was a source of pleasure to them both as long as they lived.

Dr. Jackson's accomplishments are too well known to need reiteration, but I should like to mention two of his activities. He took a prominent part in the organization of the American Board of Ophthalmology and was its first president, and in 1917 he became the first editor of the third series of THE AMERICAN JOURNAL OF OPHTHALMOLOGY, which combined a number of small publications.

Dr. Jackson joined the Pacific Coast Oto-Ophthalmological Society in 1911 and attended every one of its meetings until 1939. In the course of these meetings it was my great privilege to become well acquainted with him. He was a modest man, always liberal in praise of the work of others, always genial and friendly, an indefatigable worker, and a great teacher who was interested above all in the young men in ophthalmology. The warmth of his personality was never more apparent than during the early morning walks so many years ago when it was my good fortune to accompany him through the grounds of the old Del Monte Hotel. His words of advice and encouragement to me as a young man were never-to-be-forgotten gems.

And so I feel that indeed it is a great honor for me to be allowed to present this Edward Jackson Lecture.

INTRODUCTION

It has been known for many years that the surgery of congenital cataracts does not offer as good a prognosis as the surgery of cataracts in the adult. As long ago as 1805, James Ware, in his book *Chirurgical Observations Relative to the Eye,* made the statement, "Operation is not so certain a

*From the E. S. Heller Laboratories of the Department of Ophthalmology, University of California Medical Center, San Francisco. Presented at the 60th annual session of the American Academy of Ophthalmology and Otolaryngology, October, 1955, Chicago.

Acknowledgment is made to Dr. Kenneth C. Swan, Dr. Algernon B. Reese, Dr. Alston Callahan, Dr. Frederick Carriker, and the Armed Forces Institute of Pathology for some of the material and histories used in this paper. I wish particularly to express my thanks to Gen. Elbert DeCoursey and to Dr. Lorenz E. Zimmerman of the Armed Forces Institute of Pathology, who made it possible for me to obtain 32 case histories and sections of eyes from the institute.

cure for cataract in children as in persons of more advanced age." A certain percentage of the failures can be attributed to congenital anomalies that interfere with the restoration of vision; others are the result of well-organized early and late postoperative complications. Clinical observation suggests that certain of these complications may be associated with the type of operative procedure employed. In a search for histopathologic confirmation of such an association, a study has been made of 56 eyes removed after surgical failure.

The operations employed for the correction of congenital cataracts are (1) simple discission, usually repeated a number of times; (2) through-and-through discission (Ziegler operation); (3) discission followed by linear extraction; (4) simple linear extraction; and (5) linear extraction with limbal incision and iridectomy, with or without sutures. Optical iridectomy is used so rarely that it is not considered in this discussion.

The complications of congenital cataract surgery and their possible relation to type of surgery

The most frequent complications of congenital cataract surgery are glaucoma, pupillary displacement or occlusion, and retinal detachment. Seen less frequently are corneal changes (for example, edema and bullous keratitis), epithelization of the anterior chamber, uveitis, sympathetic ophthalmia, atrophy of the globe, phthisis bulbi, endophthalmitis, and panophthalmitis.

Glaucoma

The causes for this complication which have been reviewed by Chandler,[3] are:

1. A rapid swelling of the lens which pushes the iris forward and blocks the pupil. This is most likely to occur after discissions in which the opening in the capsule has been too small.

2. The retention of a large amount of cortex in the anterior chamber. This can occur in discission or in linear extraction. When it occurs in linear extraction,[4] opening the wound and washing out the cortex controls the glaucoma.

3. Blocking of the pupil as a result of iris bombé. This complication occurs when the pupil is not well dilated, or as a result of considerable inflammatory reaction.

4. The formation of peripheral anterior synechias as a result of delayed restoration of the anterior chamber. This complication occurs in linear extraction and can be prevented if the incision is made at the proper angle so that a valvelike opening is established. The injection of air before the patient leaves the table is also an important preventive. The importance of restoring the chamber at the time of operation has been stressed by Otto Barkan.[2]

Chandler[3] regards incarceration of iris or lens material in the wound as another frequent cause of peripheral anterior synechias.

5. Blocking of the pupil by vitreous and filling of the anterior chamber by vitreous. This complication as a cause of secondary glaucoma has been stressed by Velhagen.[19] It may occur after linear extraction when there has been vitreous loss, but it is most likely to occur after repeated discissions. At times the vitreous completely fills the anterior chamber; in this event it is probably a factor in the production of peripheral anterior synechias. If linear extraction is properly performed, there is little danger of vitreous loss.[5]

Pupillary displacement or occlusion

The principal causes of pupillary displacement, as given by Huerkamp,[11] are prolapse of the iris, contusion of the iris, and prolapse of the vitreous. Huerkamp found that in 52 percent of cases that had had five operations there was pupillary displacement. In his series he found that the greater the number of operations, the higher was the percentage of pupillary displacement.

Occlusion of the pupil may result from the formation of a thick membrane composed of

capsule and lens material, or of a complicated membrane due to inflammation, organized exudate, or hemorrhage. Velhagen[19] stated that in evaluating a membrane or aftercataract it was difficult to differentiate between proliferation of the capsule and the formation of an inflammatory pupillary membrane. He advised that these membranes or aftercataracts be operated upon by discission with deWecker scissors so as to prevent pulling on the ciliary body which could cause hemorrhage in the anterior chamber. Denig,[7] Chandler,[3] and Cordes[4] have all stressed the fact that failure to do an iridectomy in those cases in which the pupil will not dilate preoperatively may be another factor in the production of occlusion of the pupil. Horay[10] felt that the small, bound-down pupil was probably the chief cause of postoperative complications; therefore, he advised that iridectomy be done in every case. In a personal discussion, Chandler stated that when the eye was very small and the pupil would not dilate well preoperatively, he did an iridotomy below in addition to the iridectomy, since the pupil might draw up in such cases if an iridectomy alone were done.

Velhagen[19] pointed out that as long as there is cortical material in the area of the discission, injury to the posterior capsule (vitreous) breaks up resorption and is one of the causes of inflammatory pupillary membrane formation.

Another cause of membrane formation in the pupillary area which may occlude the pupil or produce posterior synechias is the discontinuance of mydriatics before all the cortex is absorbed.

Retinal detachment

This important postoperative complication has received a good deal of attention. As stated by Doggart,[8] an important consideration to be borne in mind is the predisposition of the aphakic eye to retinal detachment. The association of detachment with aphakia is not always apparent, however, since 20 years or more may elapse before the retina detaches and by that time the patient is likely to be under the care of another ophthalmologist. Foster Moore[14] felt that removal of the lens, whether by extraction or discission, predisposed to development of detachment of the retina. Doggart[8] went so far as to state that enough evidence had accumulated to suggest that an eye deprived of its lens had at least one chance in four of sustaining retinal detachment within two or three decades.

Denig,[7] Barkan,[2] Cordes,[4] Doggart,[8] and others have all maintained that retinal detachment is most apt to be a late complication.

Shapland[17] found that the average interval between discission and the onset of detachment was 24.6 years. A number of reasons for this delay have been given. Denig[7] feels that delayed resorption of lens material could lead to recurrent irritation of the uvea, which might produce a delayed detachment. Huerkamp[11] found that the pupil was displaced in 54 percent of the cases of retinal detachment.

Most authorities agree with Chandler[3] that the more the vitreous is disturbed, the greater the danger of retinal detachment as a late complication. Vitreous loss at the time of operation, with vitreous incarcerated in the wound, is apt to result in cicatrization, later in contraction, and eventually in detachment through traction.[17] Owens and Hughes[16] state that the type of operation relates significantly to postoperative complications, and Chandler,[3] Barkan,[2] Horay,[10] Knapp,[13] and others all agree that late detachment occurs much more frequently after needling, especially repeated needling, than after linear extraction. Foster Moore,[14] found that seven percent of all eyes operated upon for congenital cataract by needling developed retinal detachment; Shapland[17] found the figure to be 10.7 percent against 2.2 percent in senile cataract. In 22 patients reporting to Moorfields with retinal detachment after needling, 40 eyes had been operated upon; at the end of an average of 24.6

years, there were 33, or 82.5 percent, with retinal detachment.

Neame[15] felt that the operation devised by Ziegler should be abolished, since detachment was more likely to follow it than other procedures, and this opinion was concurred in by Spaeth.[18] Cridland[6] agreed that any procedure that caused disturbance of the vitreous was a bad thing. He found glaucoma and detachment in a series of eyes which had undergone Wheeler discissions, and he emphasized that in performing a capsulotomy for an aftercataract or secondary membrane, the minimum procedure should be adopted which would produce a central opening.

In his series Shapland[17] found that progressive myopia must be considered as a possible etiologic factor. Trauma accounted for 13.6 percent of his cases. As a possible explanation for the evolution of the detachment, he suggested further that in a certain percentage of cases the repeated needlings, especially when applied to a dense capsule, produced traction on the zonule and caused a retinal dialysis; that the retinal margin flapped inward toward the vitreous, thus hindering reattachment, and that then, years later, as the vitreous slowly underwent degenerative changes, the more fluid portion got behind this flap and initiated a retinal detachment in the usual manner. Holes are found only rarely in these cases (in 15.2 percent of Shapland's series), and the operative prognosis is usually very poor.

Corneal edema, bullous keratitis, and vascularization of the cornea develop in some of these cases as a result of other severe complications. As a more direct association, Velhagen[19] suggested the possibility that corneal dystrophy might occur if vitreous touched the posterior surface of the cornea after vitreous loss or after a breaking of the hyaloid which would permit vitreous in the anterior chamber. Denig[7] also noted that there seemed to be some association between retinal detachment and corneal epithelial dystrophy.

Phthisis bulbi

Phthisis bulbi is another complication of congenital cataract surgery. Huerkamp found it in 69 percent of the eyes that developed "severe complications" postoperatively. Velhagen[19] felt that the pulling action of the capsule forceps in attempts to remove a shrunken cataract or a very dense aftercataract could cause a good deal of damage to the ciliary body which would result later on in phthisis bulbi. Kiss[12] made the interesting observation that the usually harmless iridectomy for prolapsed iris is a dangerous procedure, predisposing to phthisis bulbi, when performed in the first year of a child's life.

The relation of type of surgery to clinical results

Clinical experience with congenital cataract surgery suggests a definite relationship between the type of surgery and the quality of the results achieved. The reports of Falls,[9] Horay,[10] Owens and Hughes,[16] Bagley,[1] Chandler,[3] and others would seem to indicate that some form of linear extraction is the operation of choice. If the pupil can be dilated easily preoperatively, the simple linear extraction would seem to be preferable; if the pupil is difficult to dilate, iridectomy followed by linear extraction is indicated.

Experience has shown that no one operation can be recommended to the exclusion of all others. In cases of membranous cataract, shrunken cataract, or aftercataract, linear extraction quite obviously is not indicated because of the danger of vitreous loss when an attempt is made to grasp the capsule. There is added danger in the fact that in such cases there are often adhesions to the vitreous face. These cases can readily be diagnosed on the basis of a deep chamber and iridodonesis. Some form of discission, with the least possible damage to the vitreous, is then indicated.

TABLE 1

FIFTY-SIX EYES ENUCLEATED AFTER FAILURE OF CONGENITAL CATRACT SURGERY

Type of Surgery	Number of Cases	Percentage
Discission	40	71.6
Linear extraction	14	25
Type of surgery unknown	2	3.5

A STUDY OF 56 EYES REMOVED AFTER CONGENITAL CATARACT SURGERY

In an attempt to determine, on a histopathologic basis, the relationship between failure in congenital cataract surgery and the type of operation employed, 56 eyes were studied microscopically. Forty (71.6 percent) of the 56 had been enucleated after needling, 14 (25 percent) after linear extraction, and two (3.4 percent) after operations the type of which had not been recorded (table 1). Of the eyes in which a needling had been done, 29 (72 percent) had had multiple needlings; 11 (25 percent) had had a single needling, one of which had had a Ziegler through-and-through operation (table 2). One of the linear extractions followed a needling.

POSTOPERATIVE COMPLICATIONS

Glaucoma

Of the 56 eyes removed, 26 (46 percent) had had glaucoma. Of this group, 21 eyes had been removed after needling, four after linear extraction, and one after the Ziegler through-and-through operation (table 3). Of the 21 glaucomatous eyes enucleated after needling (52 percent of the eyes needled), 16 (71 percent) had had from two to six needlings. The four glaucomatous eyes that had had linear extraction represented a total of 27 percent of all linear extractions. Thus, in this series, glaucoma was very much more frequent after needling, especially after multiple needlings, than after linear extraction.

TABLE 2

FORTY EYES OPERATED UPON BY DISCISSION

Type of Discission	Number of Cases	Percentage
Multiple discission	29	72
Single discission	10	26
Ziegler through-and-through	1	2

TABLE 3

GLAUCOMA PRESENT IN 26 EYES (46 PERCENT OF ALL CASES)

Type of Surgery	Number of Cases	Percentage
Multiple discission	16	61.5
Single discission	5	19.4
Ziegler through-and-through	1	3.8
Linear extraction	4	15.3

Factors leading to the development of glaucoma. There was occlusion of the angle in 20 of the 26 glaucomatous eyes, and all but two of them were eyes enucleated after needlings. In most instances there were several contributing and usually related factors underlying the glaucoma.

1. *Uveitis* was a contributing factor in many cases, as evidenced by the presence of anterior synechias that obliterated the chamber angle. There was one case (5) of absolute glaucoma. In some instances there were also posterior synechias, for example, Case 35, and in still others a considerable part of the iris was adherent to the posterior corneal surface, for example, Cases 7, 8, and 27.

2. *Buphthalmos* was present in five cases, all of which had been subjected to multiple needlings. The patient in Case 7 had a normal eye until after a second needling at 12 months, when glaucoma and buphthalmos developed. In Case 11, that of a 25-year-old man, the buphthalmos developed after several "operations" in childhood, and the eye was enucleated because of the pain of absolute glaucoma. Case 27 was that of a 12-year-old boy whose eye was normal in size until after the second needling when he was four years of age, when it began to enlarge. In Case 30,

that of a nine-year-old boy, there was marked enlargement of the anterior segment with an intercalary staphyloma; the mother was not sure after which of several needling operations the changes had started. Case 43 was that of a seven-year-old boy with rubella cataracts. The left eye started to increase in size when the child was two years of age, after the second needling. The right eye, which also had a congenital cataract, had a single needling, five months after the birth of the child, without complications.

3. *Intraocular hemorrhage* was the cause of glaucoma in 10 eyes. Eight of these had had multiple needlings. In two cases the hemorrhage resulted from trauma and can therefore be excluded from the present discussion. Two cases followed surgery for glaucoma that developed after cataract surgery: in Case 4 an iridencleisis had been attempted in connection with a linear extraction; in the other case the operative hemorrhage followed a third discission.

4. *Spontaneous hemorrhage* occurred in five cases. In Cases 5 and 6, massive subchoroidal hemorrhages developed 20 years after multiple needlings. In Case 43, massive recurrent hemorrhage occurred 50 years after multiple needlings; the eye had had an old detachment of the retina. In Case 21, in which there was recurrent hemorrhage four years after surgery, a mass of proliferated epithelial tissue, containing blood and needlelike spaces (cholesterol slits), could be seen in the angle inferiorly; superiorly, the angle was open but narrow.

5. *Pupillary membrane* of a dense nature occurred in six cases. In Case 4, in which a linear extraction had been followed by an unsuccessful iris inclusion operation, there was a fibrous membrane extending inward from the anterior chamber angle meshwork and the iris. In Case 17, that of a 14-year-old boy, a severe uveitis developed after a discission and the eye was enucleated for fear of sympathetic ophthalmia. Examination revealed an inflammatory pupillary membrane adherent to the anterior surface of the iris in addition to the degenerated lens substance. There was a massive anterior capsular cataract. In the four other cases, there was membrane formation with traction on the ciliary body and retina, which will be discussed later.

Two cases warrant special comment.

6. *Block of the pupil by vitreous.* In Case 21 the eye developed glaucoma after the second discission. The pupil was completely occluded, with vitreous prolapse and subsequent adhesions of vitreous to the iris (fig. 1). Gonioscopic examination revealed a completely blocked angle. In microscopic section the vitreous appeared in the form of a thin pupillary membrane adherent to the anterior iris surface (fig. 2). In addition, there were posterior synechias to the lens remnants behind the iris in the form of a Soemmerring ring.

In Case 42, that of an eight-year-old boy, the second discission was followed by hemorrhage and glaucoma. Microscopic examination revealed iris bombé with peripheral anterior synechias. A cuticular membrane was seen on the anterior border layer at the site of the operative wound; it extended to the pupillary margin of the iris, to become continuous with a delicate membrane which stretched across the pupillary opening to the opposite iris leaf, to which it was adherent. The iris was adherent to the lens remnants. The cuticular membrane, probably a condensed vitreous layer, extended backward through the central opening to the lens capsule.

It was Chandler[3] who particularly directed my attention to these cases. The development of glaucoma following congenital cataract surgery may easily be overlooked because it is not suspected and because of the difficulty of examining the eyes of children with congenital glaucoma under the slitlamp. Although it can develop after linear extraction when there has been vitreous loss, it occurs most frequently after repeated discissions. If a small pupil is completely blocked by a membrane, the vitreous, when cut into, may

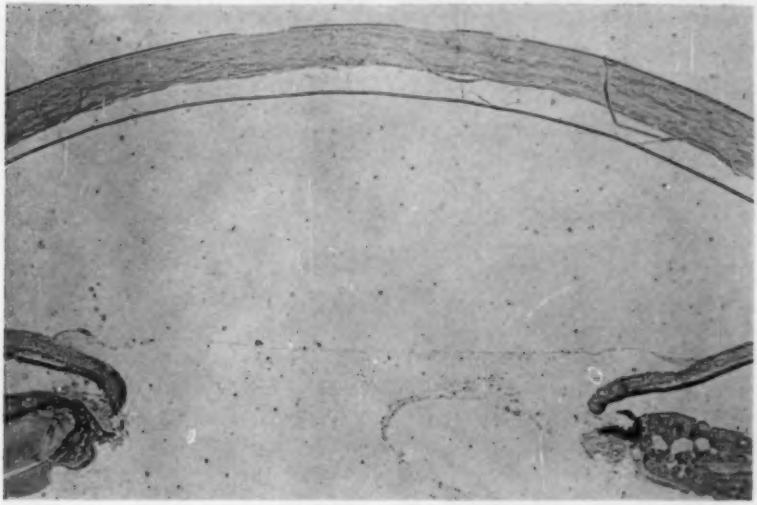

Fig. 1 (Cordes). Pupil occluded with vitreous prolapse and adhesions to iris surface.

come forward and again block the pupil. As the pressure increases in the posterior chamber, an iris bombé may be produced, the vitreous being forced into the anterior chamber, sometimes entirely filling it. As Chandler[3] points out, the possibility of this complication is another reason why von Graefe's dictum, "Never do a needling in the presence of a small pupil," should be observed.

7. Glaucoma after Ziegler through-and-through discission. Case 9 is a most instructive one. This patient, a 22-year-old woman, was subjected to a Ziegler through-and-through discission. Three days later the eye became red, painful, and hard; the diagnosis

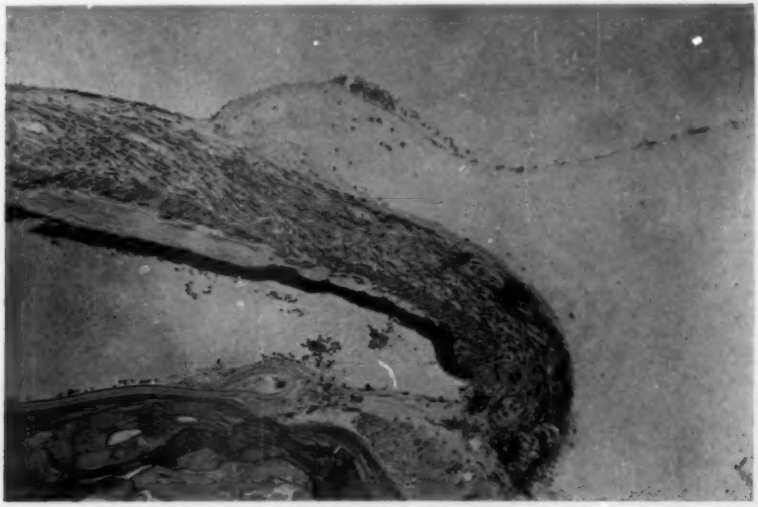

Fig. 2 (Cordes). High-power view to show vitreous adhesion to anterior iris surface.

was that this was an anaphylactic reaction. An attempt to remove the cortex through a keratome incision was unsuccessful and accompanied by vitreous loss. Following surgery, the eye developed endophthalmitis and detachment of the retina, with loss of light perception. The resultant soft, degenerated, sightless eye was enucleated.

Microscopically, the eye did not present the picture of phacoanaphylaxis described by Verhoeff and Lemoine, so that in all probability the glaucoma was caused by the rapid swelling of the lens and resultant blocking of the angle. Since it is almost impossible to avoid vitreous in the anterior chamber after a Ziegler operation, the removal of lens substance without vitreous loss and its attendant complications, if glaucoma should develop, becomes difficult, if not impossible. This case bears out the clinical observation that the possibility of this complication is one of the real disadvantages of the Ziegler operation.

8. *Epithelial downgrowth.* A downgrowth of epithelium may be a factor in the production of glaucoma. Case 35 was that of a 29-year-old man who had had multiple needlings. He developed a red, painful eye that did not respond to therapy and was enucleated. Examination of the sections showed the iris incarcerated in a surgical scar on one side. There was a downgrowth of epithelium which had encircled the posterior chamber and had adhered to the posterior iris surface and to the anterior surface of the Soemmerring ring (fig. 3). One mass of epithelial cells was anterior to the iris (fig. 4).

Detachment of the retina

Detachment of the retina occurred in 23 of the 56 cases (41 percent): 18 of these followed needling; four followed linear extraction; and one occurred 10 years after congenital cataract surgery of unknown type (table 4). In one patient the detachment developed immediately after a single needling, and in another case it developed soon after a linear extraction. In another patient it followed the cutting of an after-cataract with deWecker scissors.

In one patient (Case 3) a discission was done for congenital cataract, and postoperatively there was a white mass in the pupillary area which was diagnosed as retinoblastoma. The eye was enucleated, and microscopic examination showed the mass to be an old retinal detachment.

There were 13 cases of detachment that

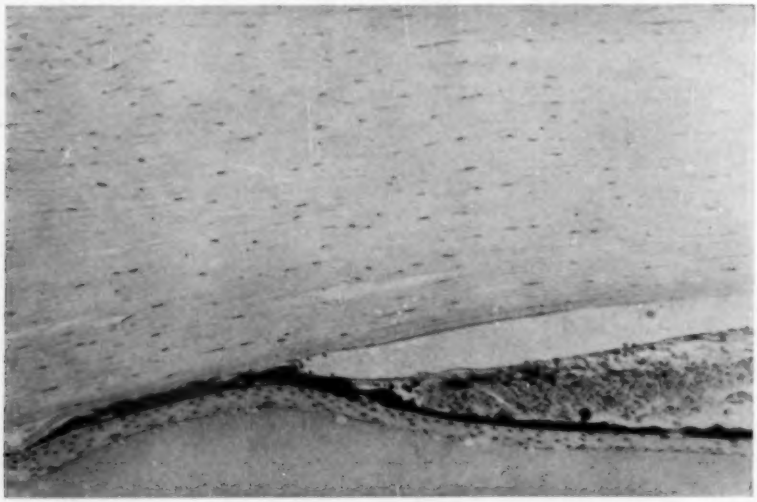

Fig. 3 (Cordes). Downgrowth of epithelium in anterior chamber.

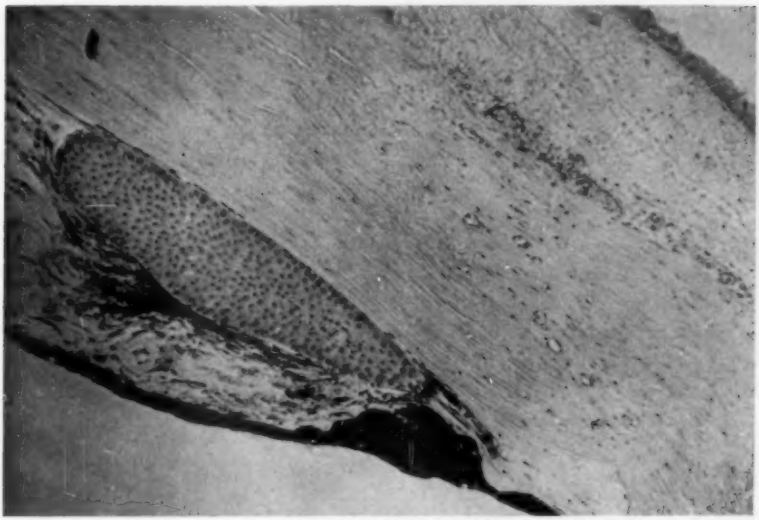

Fig. 4 (Cordes). Epithelial cells between iris and cornea.

followed multiple needlings; this was 45 percent of all the cases that had multiple needlings. In Case 24 the condition developed immediately after the third needling.

In Case 48 the patient was struck in the eye after the second of two discissions. This resulted in a detachment of the retina associated with recurrent intraocular hemorrhage. The eye developed a chronic uveitis and became atrophic.

Of particular interest are the 12 cases that developed late detachment, 11 after multiple discissions and one 26 years after a linear extraction (table 5). The longest interval between operation and detachment was in Case 43, in which the detachment developed 33 years after the last needling (fig. 5). In some instances it was difficult to determine the exact time of the detachment, but, so far as could be determined, the average interval after surgery for this group of 11 cases was 22.2 years. This corresponds closely with Shapland's clinical finding of an average of 24.6 years between needling and detachment.[17]

The reasons for enucleating the 23 eyes with detachment are interesting. In seven cases there was extensive recurrent intraocular hemorrhage followed by phthisis bulbi. In three instances phthisis bulbi occurred

TABLE 4

DETACHMENT OF RETINA IN 23 EYES (41 PERCENT OF ALL CASES)

Type of Surgery	Number of Cases	Percentage
Discission		
Single	5	21.7
Multiple	13	56.5
		78.2
Linear extraction	4	17.3
Unknown	1	4.5

TABLE 5

LATE DETACHMENT OF THE RETINA (12 CASES)

Type of Surgery	Number	Percentage
After multiple discission	11	37.9 percent of all multiple discissions
After linear extraction	1	7.1 percent of all linear extractions
Total	12	

Average time between surgery and detachments, 22.2 years.

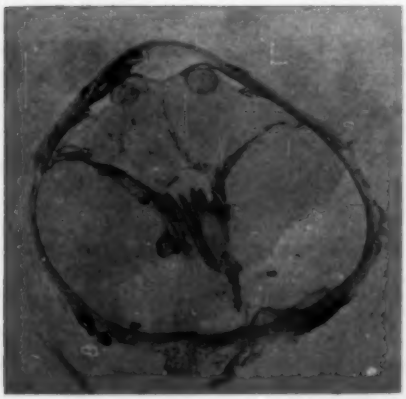

Fig. 5 (Cordes). Retinal detachment occurring 33 years after last needling.

without hemorrhage following chronic inflammation. In one there was a severe uveitis that developed after an unsuccessful attempt at retinal detachment surgery; in another there was a marked secondary glaucoma that did not respond to therapy.

One 24-year-old woman (Case 5) who had had multiple discissions when she was four years of age, developed a retinal detachment and an endophthalmitis that went on to absolute glaucoma, which necessitated enucleation.

Of the three linear extractions with detachment of the retina, the eye was enucleated in one instance because of the degenerative changes, including bullous keratitis, that followed the cutting of an aftercataract by deWecker scissors; in the second case the cause of enucleation was absolute glaucoma with organized hemorrhage accompanied by an intercalary staphyloma. Absolute glaucoma was also the indication for enucleation in the third case.

In the one case in which the type of surgery was unknown, the detachment was followed by phthisis bulbi and a painful eye.

Shapland's theory, as given above, that traction may sometimes be a factor in the production of detachment, seems to be substantiated by several of the cases in this series that followed multiple needlings (fig. 6): In Case 14 there was a cyclitic membrane near the pupillary area which incorporated both the posterior surface of the iris and a portion of the completely detached retina (fig. 7). In one eye, Case 43, after three needlings, some delicate strands of tissue extended across the pupillary space and connected with a membrane on the anterior surface of the iris and with bands of tissue extending to the ora serrata above, below, and backward to the detached retina, which was ruptured just above the disc. In Case 44, there had been five needlings; at a point where an incision had been made to needle the lens there was a downgrowth of fibrous tissue which extended back into the posterior portion of the globe; by contracting, it had pulled on the retina and caused a detachment of both retina and choroid (fig. 8).

In Case 37, in which multiple needlings had been followed by an iridectomy for glaucoma, connective tissue extended from the deeper aspects of the scar into the anterior chamber to become continuous with lens, iris, and detached retina. Similar changes were present in Case 55, that of a patient who had also had multiple needlings.

These findings would seem to explain, at least in part, why the operative prognosis for

Fig. 6 (Cordes). Late detachment of retina with strands extending back to detached retina.

Fig. 7 (Cordes). Late detachment of retina after multiple needlings (whole eye in Figure 5).

TABLE 6

PRINCIPAL COMPLICATIONS OBSERVED IN 56 EYES REMOVED AFTER FAILURE OF CONGENITAL CATARACT SURGERY

	Discission		Linear Extraction	Ziegler Operation	Unknown Type	Number	Percentage Total Cases
	Single	Multiple					
Glaucoma	5 8.9%	16 28.1%	4 7.1%	1 1.9%		26	46
Retinal detachment	5 8.9%	13 23.1%	4 7.1%		1 1.9%	23	41
Uveitis	2 3.5%	7 12.5%	2 3.5%	1.9%	1 1.9%	13	23.3
Sympathetic ophthalmia			1 1.9%			1	1.9
Cyclitic membrane	2 3.5%	6 10.6%	2 3.5%	1.9%	1 1.9%	12	21.4
Panophthalmitis			4 7.1%		1 1.9%	5	9
Phthisis bulbi		6 10.6%	3 5.4%		1 1.9%	10	17.9
Optic atrophy	6 10.7%	19 33.9%	5 8.9%		2 3.5%	32	57

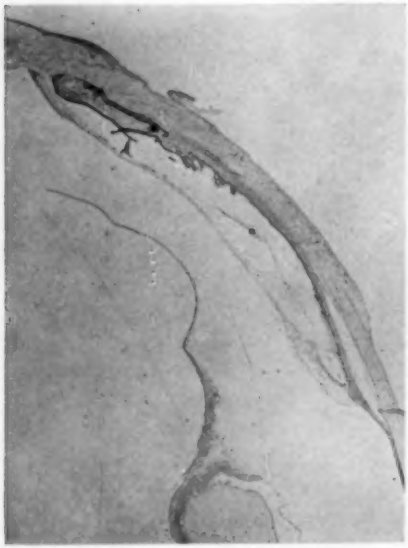

Fig. 8 (Cordes). Portion of downgrowth of fibrous tissue from incision to detached retina.

retinal detachment surgery is so poor in these cases.

In Case 50, a linear extraction had been done 36 years before enucleation. Data on the time the detachment had occurred were not available, but from the appearance of the retina and the presence of ossification it can be assumed that the detachment had been present for some time prior to enucleation. The blind, phthisical eye was enucleated because of a severe iridocyclitis. Microscopic examination revealed a fibrohyaline cyclitic membrane extending from the operative scar to the iris, lens remnants, ciliary body, and detached retina.

In Case 8, enucleated two and a half years after surgery, a detachment followed a linear extraction. The nervehead was pulled forward and gliosed; it contained laminated and apparently calcific drusen. Spontaneous hemorrhage was apparently another reason for enucleation.

In five cases of late detachment that occurred 14, 15, 16, 20, and 22 years after multiple needlings, the detachment was apparently caused by spontaneous subretinal hemorrhage; in Case 48, however, the detachment followed extensive intraocular hemorrhage five months after the second needling.

Uveitis

There were 13 cases (20.8 percent) in the series in which uveitis was at least one of the outstanding symptoms. Seven of these occurred in patients who had had multiple needlings, two followed a single needling, two followed linear extraction, and one followed trauma to an eye that had been successfully operated upon two years previously by linear extraction. In one instance the uveitis followed two unsuccessful attempts to remove the cataract through a corneal incision.

In Case 48 the patient developed chronic uveitis, detachment of the retina, and vitreous hemorrhage after the second needling.

Sympathetic ophthalmia

Sympathetic ophthalmia was diagnosed clinically and microscopically in Case 36. Three months previously the patient had had a linear extraction accompanied by vitreous loss and a postoperative iris prolapse that was excised. Chronic uveitis supervened, and 10 weeks after surgery the eye not operated upon developed uveitis. The exciting eye was enucleated.

Microscopic examination revealed a cyclitic membrane that included lens remnants and was invaded by plasma cells, lymphocytes, and macrophages. There was marked inflammation, granulomatous in nature, of the rest of the iris, ciliary body, and anterior choroid. The optic nerve was swollen and there were inflammatory cells about some of the smaller vessels. The picture was typical of sympathetic ophthalmia. Treatment of the remaining eye by cortisone therapy resulted in recovery with 20/30 vision.

In Case 33, which was diagnosed clinically as endophthalmitis, there was diffuse infiltration of the choroid by lymphocytes and plasma cells suggestive of early sympathetic ophthalmia. It was impossible in this case to obtain any clinical information on the remaining eye.

Cyclitic membrane formation

Dense cyclitic membranes had formed in 12 cases: six after multiple needlings, two after a single discission, two after linear extraction, one after a Ziegler through-and-through operation, and one after an unknown type of surgery (fig. 9). In eight of these cases the eye was enucleated between seven days and six months after surgery. In four cases enucleation took place 18, 23, 24, and 37 years after surgery. In Case 14, in which the eye was enucleated 23 years after surgery, the cyclitic membrane contained bone, indicating that it had been present for many years. The other three cases (20, 47, and 50) were phthisical eyes, which also indicated that the cyclitic membrane was of long standing.

Pupillary membrane formation

Occlusion of the pupil by membrane formation occurred in 12 cases. In Case 47, in which the type of surgery had not been recorded, there was occlusion of the pupil by a dense pupillary membrane which extended along the anterior surface of the iris. Anterior peripheral synechias were also present. While details of these cases are not available, examination of the slides shows a small pupil in each case and suggests that they were cases in which the pupil could not be dilated well before surgery. Clinically these cases always result in occlusion of the pupil postoperatively. This had been recognized for many years. Von Graefe observed this and warned against needling congenital cataracts if the pupil could not be well dilated preoperatively.

Panophthalmitis

Panophthalmitis had obtained in five cases. Case 12 was probably a linear extraction followed by panophthalmitis and later phthisis bulbi. In Case 13, multiple needlings had been followed by an attempt to remove the

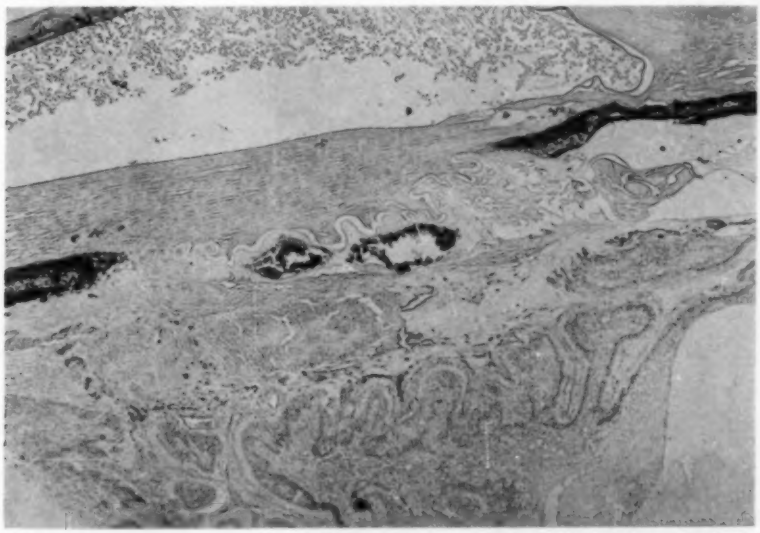

Fig. 9 (Cordes). Dense cyclitic membrane with lens capsule and retina incorporated.

remainder of the lens through a limbal incision. Cases 23, 28, and 54 were linear extractions, followed within a few days by panophthalmitis. Thus, all five instances of panophthalmitis followed incision of the eyeball.

Phthisis bulbi

Phthisis bulbi was found by Huerkamp[11] in 69 percent of eyes that developed "severe complications." In this series of enucleated eyes, only 10 (17.9 percent) were phthisical. In Case 47 the phthisis bulbi followed some unrecorded operative complication. Cases 50 and 54 were linear extractions in which the phthisis followed a low-grade uveitis of long standing. One case (Case 12) followed panophthalmitis after linear extraction; four followed severe inflammation after the last of multiple needlings that were done, respectively, 13, 16, 18, and 20 years before enucleation. In Case 48 the phthisis resulted from recurrent hemorrhage and inflammation following trauma five months after the second needling.

Corneal changes

Corneal changes were noted in 24 (42 percent) of the series. These ranged from edema to chronic pannus, degenerative changes, and suppurative keratitis. In 16 of these cases there was also glaucoma, and in eight of the 16 it was absolute. In three cases the keratitis appeared to be associated with vitreous in the anterior chamber and against the posterior corneal surface. Bullous keratitis was seen in three cases. In view of Denig's observation of an apparent association between retinal detachment and corneal changes, it is interesting that 13 cases, or approximately 50 percent of the cases in this series showing microscopic corneal changes, also showed retinal detachment (fig. 10).

By far the commonest finding was corneal edema with chronic inflammation and vascularization. Case 35 illustrated this type of change. The patient, a 29-year-old man, had had multiple discissions when he was four years of age. Twenty-five years after the last operation the eye was enucleated because of pain. Vision had been lost for some time before surgery, apparently due to a detachment of the retina. The corneal epithelium was thin and irregular. Centrally, in the region where Bowman's membrane was interrupted, there was beginning epidermidalization of the epithelium and loose fibrinous

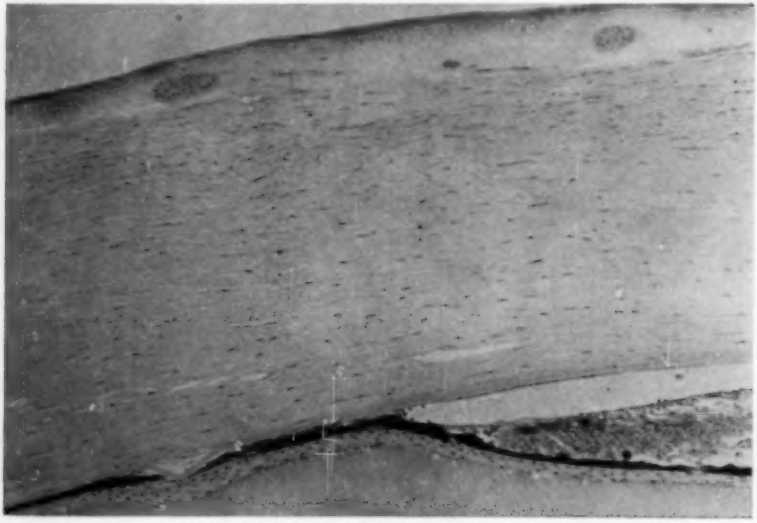

Fig. 10 (Cordes). Corneal changes associated with old detachment of the retina.

tissue beneath the epithelium. In addition, there were degenerative changes in the corneal stroma, and the corneal endothelium was atrophic.

Some of the eyes with corneal changes warrant special consideration:

Case 19 is an example of lens capsule incarcerated in the operative wound after linear extraction. It emphasizes the importance of being certain that the corneal wound does not contain lens capsule, especially when an iridectomy has been done; when a round pupil operation has been performed, the iris is usually instrumental in preventing this complication.

In Case 17, in which a diagnosis of sympathetic ophthalmia was made clinically but not confirmed microscopically, there was an unusual complication namely, a purulent infection in the needling wound. Microscopic examination revealed purulent exudate, fibroblastic proliferation, and hemorrhage filling the operative wound. The eye showed the changes of subacute iridocyclitis. This case emphasized the importance of observing meticulously the techniques of sterile surgery.

Case 9 had had a Ziegler through-and-through operation followed by glaucoma. A keratome incision was made in an attempt to remove the lens cortex. This was followed by an endophthalmitis. The scar of the incision was infiltrated with plasma cells.

Lens remnants

Lens remnants were calcified in four cases, with no apparent relationship to the type of surgery. Lens capsule was adherent to iris or incarcerated into the cyclitic membrane in five cases: two after linear extraction, two after multiple needlings, and one after a Ziegler operation. In Case 15 a small amount of lens capsule was adherent to the posterior corneal surface. In Cases 19 and 33, both linear extraction cases, there was adherence of lens capsule to the corneal wound (fig. 11). In Case 19 the scar tissue was attached to the lens capsule with the subcapsular epithelium on one side, and continued over the inner corneal surface to attach to lens remnants on the opposite side. These cases would seem to indicate the value of a large capsulotomy in linear extraction and to emphasize the importance of being certain that there are no lens remnants in the wound at the end of surgery. They also provide another argument in favor of round

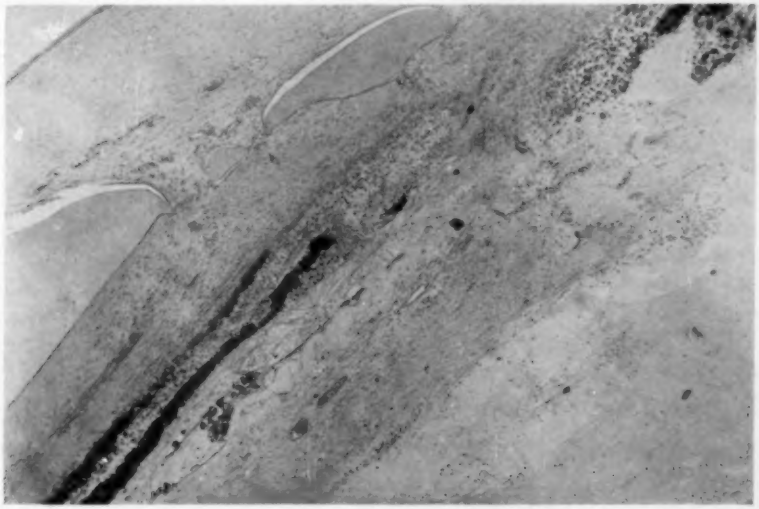

Fig. 11 (Cordes). Lens capsule adherent to wound.

Fig. 12 (Cordes). Detached retina, showing traction on the disc.

pupil operation if the pupil can be widely dilated.

Case 4 revealed a bulging scar which was the result of iridencleisis at the limbus. A fibrous membrane extended inward from the anterior edge of the ciliary body to lens remnants and replaced the chamber angle meshwork and the iris. In Case 2 the lens capsule on one side, with a small amount of degenerated substance, was attached to the iris, and lens epithelium grew onto the pupillary margin. In Case 24 the lens was completely replaced by a large, thick mass of well-organized connective tissue to which iris, ciliary body, and retina adhered. A few capsular remnants were seen in the anterior part of this tissue. In Case 49 there were posterior synechias to the lens capsule, and in Case 55 lens remnants were adherent to the fibrovascular tissue occupying the anterior chamber.

Optic nerve

Optic atrophy was present in 32 cases, of which 23 had been subjected to multiple needlings. In seven of the cases, or 31 percent, there was a glaucomatous cup. In the cases of retinal detachment it was characteristic that the retina was pulled away from the disc. This was illustrated by Case 8, in which there was gliosis of the nervehead, which was pulled forward and contained laminated and apparently calcific drusen. The lamina cribrosa did not appear to be depressed. In Case 33 the retina was similarly detached and appeared to have been partially torn from the disc by the traction on the retina (fig. 12), although an artefact must be considered.

In Case 11 the nervehead was detached from the deeply depressed lamina cribrosa and the retina was pulled into and over the disc, apparently by traction from retinal scars near the disc.

In Case 41 the optic nerve showed deep cupping which was filled with proliferated glial tissue.

Ossification

Ossification was present in five eyes. In Case 14, in which there had been multiple

needlings 23 years before enucleation, there was ossification in the cyclitic membrane and posterior choroid; in Case 16, enucleated 32 years after multiple needlings, the ossification was in the posterior choroid; in Case 43, enucleated 50 years after multiple needlings, and in Case 50, in which a linear extraction had been done 37 years before enucleation, there was also ossification in the choroid; while in Case 46 the ossification occurred in the old detached retina. How long the retinal detachments had been present could not be determined. As was to be expected, ossification was present only in cases in which the pathologic changes had been of long standing.

Drusen

Drusen were seen rather frequently. The youngest patient in this group of cases was a girl four years of age, who had had a linear extraction three years prior to enucleation. The formation of drusen is a common finding after detachment of the retina.

Retinoblastoma

Case 25 warrants special consideration (fig. 13). The patient, who was 15 months old at the time of enucleation, had been seen six months previously. At that time he had an opaque lens of the right eye which, the mother stated, had been present for several months. The condition was diagnosed as infantile cataract, and a needling operation was performed. At the time of surgery the surgeon noted that the lens was "very opaque and semisolid, appearing more like calcium." Six months later the patient was again brought to the doctor; and at that time, the "whole anterior chamber seemed full of calciumlike material," and the eye was enucleated.

Microscopic examination of the enucleated eye revealed a retinoblastoma with necrosis and calcium degeneration (stage III). The tumor had invaded almost all of the structures of the eye. This case points up the importance of keeping retinoblastoma in mind, especially in those cases in which there is a history of the development of the opacity several months after birth.

Pseudotumor

Case 51 is of interest as a problem in differential diagnosis. A congenital cataract had been needled when the patient was two

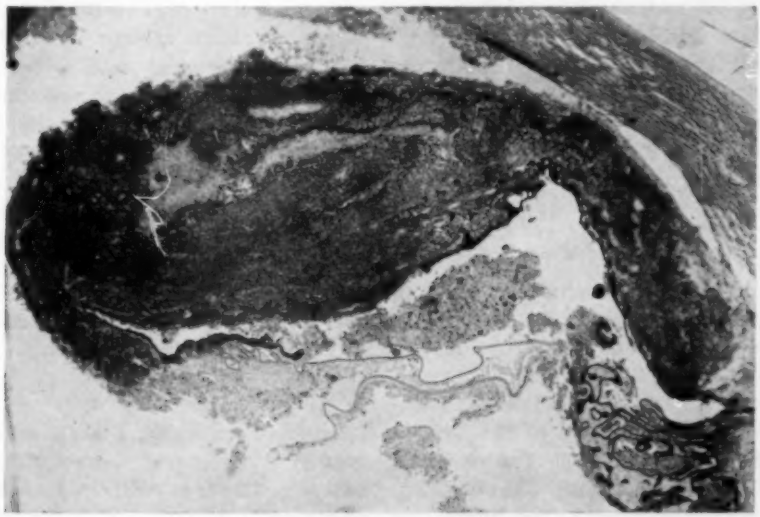

Fig. 13 (Cordes). Retinoblastoma filling anterior chamber.

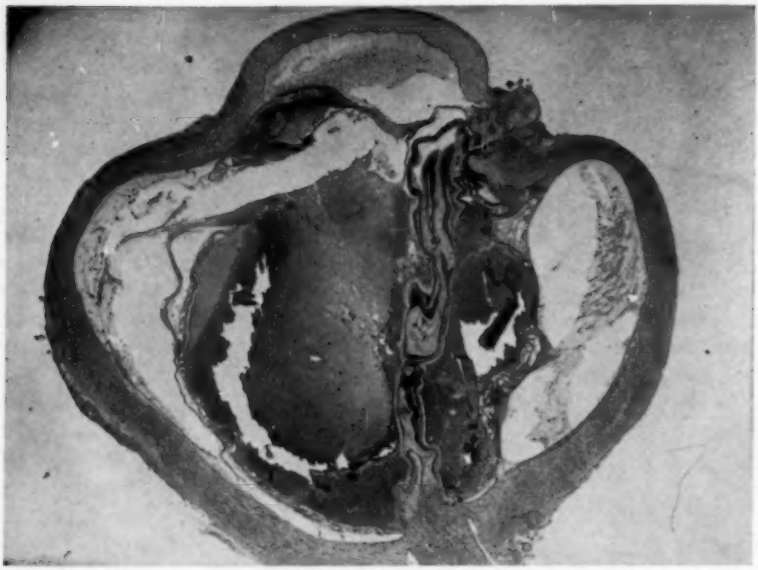

Fig. 14 (Cordes). Expulsive hemorrhage occurring on operating table in a six-year-old patient.

years of age. This was followed by the development of a pigmented tumorlike mass immediately behind the pupil. The mass failed to grow over a period of 10 years, and the eye was then enucleated because of a chronic uveitis. Microscopic examination revealed retinal detachment with adhesion of the retina to lens remnants in the pupillary area, associated with proliferation of the pigmented epithelium of the ciliary body onto the anterior surface of the detached retina. These, then, were the components of the pigmented mass that had simulated a melanoma.

Spontaneous expulsive hemorrhage

So far as could be determined, spontaneous expulsive hemorrhage, though a rare complication of cataract extraction, has never been reported in connection with congenital cataract surgery. In Case 53, a six-year-old boy was admitted to the hospital for extracapsular extraction of a congenital cataract present from birth. Clinical examination revealed an opacity so diffuse that the fundus could not be visualized. Light perception and projection were present. Aside from the lens changes, the eye appeared to be normal. At surgery, when the lens capsule was grasped with lens capsule forceps, a massive intraocular expulsive hemorrhage occurred (fig. 14). Permission for enucleation was delayed one week. Microscopic examination revealed a massive detachment of the choroid by hemorrhage. The hemorrhage had ruptured the choroid anteriorly and was beneath the detached retina and in the vitreous. Aside from the changes resulting from the presence of the hemorrhage, no abnormalities were demonstrable during the week before enucleation was performed. This occurrence of spontaneous expulsive hemorrhage in a child at the time of cataract surgery would seem to be the only one on record.

Age at the Time of Surgery

In 11 (19 percent) of the 56 eyes enucleated after congenital cataract surgery, the first operation was performed when the patient was one year old or younger; the youngest child was three months old. In

six cases the only available history was that the first operation was "in childhood." In the remainder of the patients, surgery was performed between one and 30 years of age. It should be borne in mind that those cases in which surgery is indicated very early are also the cases with the greatest number of other congenital anomalies. It is difficult to draw any conclusions from this group of cases as to the influence of age on the complications of congenital cataract surgery.

Summary and Conclusions

In many of these cases, the history and clinical data were so meager that it was impossible to correlate accurately the clinical findings with the pathologic changes. Attempts to obtain further data were in most instances unsuccessful. For this reason, conclusions or opinions are to a certain extent based on supposition.

Fifty-six (56) eyes enucleated after congenital cataract surgery were subjected to histopathologic study. Needlings had been performed in 71.6 percent of the 56 eyes; and in 72 percent of the needlings, multiple discissions had been done. In one instance, a Ziegler through-and-through operation had been performed.

Glaucoma was present in 26 (46 percent) of the 56 eyes; and in 75 percent of these, the glaucoma followed a needling or, more often, multiple needlings. Uveitis, intraocular hemorrhage, the formation of cyclitic membrane, and vitreous block were contributing factors. The case of vitreous block of the pupil occurred after a second needling and illustrates one of the complications that can occur in cases in which the pupil cannot be dilated preoperatively. When this is the case, the vitreous can come forward and block the pupil. In the case in which a Ziegler operation was done, glaucoma developed as a result of the swelling of the cortex. When attempts were made to wash out the anterior chamber, which contained vitreous, complications arose that resulted in endophthalmitis. While no conclusions can be drawn from a single case, this outcome confirms what has been observed clinically, namely, that an attempt to evacuate lens cortex in the presence of vitreous in the anterior chamber usually ends in disaster.

The frequency with which anterior peripheral synechias were observed seems to emphasize the importance of early restoration of the chamber and to substantiate the clinical observation that the injection of air at the conclusion of the operation is indicated, especially in those cases in which the anterior chamber has been opened.

Detachment of the retina occurred in 23 (41 percent) of the cases in this series. In 18 instances it followed needling. Of particular interest was the fact that in 37.5 percent of the cases of multiple needling, detachment of the retina occurred in from 15 to 33 years, or an average of 22.2 years, after surgery. The theory of Shapland and others that traction is a factor in the production of detachment would seem to be substantiated by six cases in which a membrane formed between the anterior chamber and the retina, all in eyes that had had multiple discissions. The study of the eyes with delayed detachment of the retina apparently bears out the clinical observation that the more the vitreous is disturbed, the greater the chance of late detachment. Thus the operation of choice in congenital cataract, whenever possible, should be some form of linear extraction or some form of surgery in which the posterior capsule and the vitreous face are not disturbed.

Pupillary membrane formation was present in 12 cases. While it was not possible to obtain detailed data in these cases, they may very well have been cases in which it was not possible to dilate the pupil well before surgery, since in most of them the pupillary space was small. This would point to the advisability of doing a full iridectomy in those cases in which it is not possible to dilate the pupil widely before surgery.

Panophthalmitis occurred in five instances, in all of which the eyeball had been opened,

either for a linear extraction or for an iridectomy for glaucoma, after multiple discissions. It must be borne in mind that linear extraction does carry a greater risk of intraocular infection than discission.

Corneal changes ranging from edema to chronic pannus, degenerative changes, and suppurative keratitis, occurred in 24 (42 percent) of the series. In 50 percent of these, retinal detachment occurred.

In this series, only 16 percent showed *phthisis bulbi* in contrast to the 69 percent reported by Huerkamp from clinical observations. Perhaps this was due to the fact that phthisis usually causes no symptoms, and therefore the eye is often left alone.

The adherence of lens capsule to the wound in seven instances emphasizes the necessity of being certain that there are no capsular remnants in the wound at the completion of the operation.

Sympathetic ophthalmia. It is noteworthy that in only one instance was it possible to establish the diagnosis of sympathetic ophthalmia. In a second patient the examination suggested the possibility of early sympathetic ophthalmia, but there were insufficient data to warrant a diagnosis.

The presence of retinoblastoma in one case as a contributing factor to the opacification of the lens emphasizes the importance of keeping this condition in mind, especially in those cases in which the cataract develops after birth and in which the fundus cannot be visualized even grossly.

From the data available in this series, it was not possible to correlate the incidence or nature of the postoperative complications with the age of the patient when first operated upon.

The following conclusions of practical value may be drawn from this study:

1. Linear extraction is the safest operation for congenital cataract so far as both immediate results and avoidance of late complications are concerned.

2. In those patients in whom it is impossible to dilate the pupil well before surgery, a full iridectomy should be performed.

3. In cases of aftercataract, membranous cataract, or other cataract in which linear extraction is contraindicated, the procedure chosen should be the one that will do the least possible damage to the vitreous in order to avoid late detachment of the retina.

4. Multiple needlings seem to be the least desirable of all procedures, since our statistics show that 37.9 percent of the cases subjected to multiple needlings developed late detachment of the retina on an average of 22.2 years after the last needling.

5. While this series of late detachments is small, statistically the occurrence of late retinal detachments following linear extraction is significantly less than the number of late retinal detachments following multiple discissions.

384 Post Street (8).

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ROUTINE TONOMETRY*

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The importance of early detection of glaucoma has been repeatedly emphasized. Familiarizing all physicians with the disease, its incidence, and its detection is one of the ultimate goals for case finding. In mass tonometry surveys the incidence of glaucoma has been reported as 1.5 to 2.0 percent of the population over 40 years of age.[1-3] A most important starting point in glaucoma detection is the use of routine tonometry by the busy ophthalmologist. It is the purpose of this report to summarize the attempted detection of unsuspected glaucoma in one private office in an 18-month period.

Routine tonometry was performed on all refraction patients over the age of 40 years in the office of one of us (H. R. H.) during an 18-month interval. All patients with repeated borderline tensions were referred to the tonographic laboratory for evaluation and extensive studies. It should be emphasized that these were all routine asymptomatic refraction cases who would have been dismissed as having healthy eyes. All had open angles, normal discs, and full visual fields. No patients with established glaucoma, narrow angles, neoplastic, traumatic, or inflammatory diseases, and no postoperative eyes were included in this series. In the 18-month period, 49 patients out of approximately 2,000 routine refractions of persons over the age of 40 years were found to fit the criteria of an entirely normal examination except for the borderline tension readings.

From the point of view of the tonography laboratory, these patients with borderline tension readings presented most interesting diagnostic problems. In each instance repeated measurements of scleral rigidity and tonographic tracings, before and after water-drinking, were performed. The Friedenwald[4] 1955 tables were used throughout.

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† By invitation.

Attempts were made to classify each eye into a glaucoma or normal category on the basis of pressure (P_0), facility (C), and response to water. It has been pointed out recently that eyes with an established diagnosis of glaucoma and field loss can be delineated sharply from the normal by the use of the ratio P_0/C.[8] Thus, following water-drinking in a series of 175 normal and 188 eyes with chronic simple glaucoma, the ratio P_0/C was equal to 100 or more in only one percent of the normal, but in 97 percent of the glaucomatous eyes.

The present series of patients with borderline intraocular pressures provided an opportunity for further evaluating the significance of this ratio. Repeated examinations to demonstrate progression of the abnormality, as well as serial examinations of visual fields, were carried out. Some few eyes have remained in a borderline group in spite of repeated investigations over a period of six to 18 months, but in most instances a tentative diagnosis could be made.

Results

As summarized in Table 1, of the 97 eyes in this series, 42 were found to have a spontaneously decreased facility of outflow (C) and elevated intraocular pressure (P_0) sufficient to result in a ratio P_0/C of 100 or more. An additional 19 eyes had such elevated values of P_0/C only following water-drinking. These 61 eyes were classified as probable chronic, simple glaucoma. Eight additional eyes presented a picture of intermittent or persistently increased rates of aqueous secretion (over 4.0 cu. mm./min.) with elevated intraocular pressure in spite of normal facility of outflow and normal scleral rigidity. Five of these eyes had rises in intraocular pressure after water of 8.0 or more mm. Hg. These eight eyes were classified as probably hypersecretion glaucoma. Twenty eyes were found to be entirely normal even after provocative tests. The borderline readings in 12 of these eyes resulted from increased scleral rigidity. In eight eyes (both eyes of two patients and one eye of each of four patients), no decision could be made as to diagnosis because of persistently borderline values. This latter group remains under close observation.

In the short period (six to 18 months) available for follow-up, it is of interest to record the incidence of early field loss (enlarged blind spots, beginning arcuate scotomas, or both) appearing under observation in this series (table 2). Of the eight eyes diagnosed as having hypersecretion glaucoma, this occurred in five. One of these eyes developed an early Bjerrum scotoma. Of the 61 eyes diagnosed as probably glaucoma, early field loss appeared in 22 (36 percent). This occurred in 17 eyes (41 percent) of the spontaneous suspects and five eyes (26 percent) of the positive water-provocative group. Undoubtedly, the incidence of field loss would have been much higher than this if therapy had not been instituted promptly in the latter phases of

TABLE 1

TONOGRAPHIC CLASSIFICATION OF 97 EYES OF 49 PATIENTS WITH BORDERLINE TENSIONS

Diagnosis	No. Eyes
Glaucoma suspects	42 (43%)
Glaucoma suspects after water	19 (20%)
Hypersecretion suspects	8 (8%)
Total Glaucoma Suspects	69 (71%)
Normal	20 (21%)
Borderline	8 (8%)
TOTAL	97

TABLE 2

INCIDENCE OF VISUAL FIELD LOSS (6–18 months follow-up)

Diagnosis	No. Eyes	Field Loss
Glaucoma suspect	42	17 (41%)
Glaucoma suspect after water	19	5 (26%)
Hypersecretion suspect	8	5 (63%)
Total Glaucoma Suspects	69	27 (39%)
Normal	20	0 (0%)
Borderline	8	0 (0%)

TABLE 3

MIOTIC THERAPY AND FIELD LOSS IN GLAUCOMA SUSPECTS

	No. Eyes	Field Loss
Normalized by miotics	21	1 (5%)
Other suspects	48	26 (54%)
TOTAL	69	27 (39%)

this study. Thus, early field loss was demonstrated in only one eye (five percent) of the 21 eyes treated promptly with miotics. These eyes were maintained in a normalized state, as determined by repeated tonography during the follow-up period. On the other hand, 26 (54 percent) of the remaining 48 eyes suspected of glaucoma lost visual field (table 3). None of the normal eyes or undiagnosed eyes have lost field in the follow-up period.

Thus, a total of 69 of the 97 eyes in this series were best diagnosed as having early glaucoma and 27 eyes have begun to lose field. More significantly, of the 49 patients referred, 38 were suspected of glaucoma in at least one eye and 19 (50 percent) of these suspects have lost some visual field. It is apparent that routine tonometry in a series of approximately 2,000 refractions over the age of 40 years permitted the very early detection of glaucoma in at least 27 eyes and the probable detection in 69 eyes. Only 20 eyes proved to be entirely normal and at most 11 patients with borderline or apparently normal eyes bilaterally were inconvenienced by the extra examinations involved. One must conclude that routine tonometry in an ophthalmologist's office has proved to be a most valuable case finding method for early glaucoma. Furthermore, the ratio P_0/C, especially following water-drinking, appears to be a reliable means for establishing the diagnosis of glaucoma.

SUMMARY

1. Forty-nine patients over the age of 40 years out of a total of approximately 2,000 such patients appearing in one ophthalmologist's office were found by routine tonometry to have borderline tensions in the absence of symptoms or signs of glaucoma or other ocular disease.

2. On the basis of tonography and provocative tests, 69 (72 percent) of the 97 eyes were classified as glaucoma suspects; and of the 69 eyes so diagnosed, 27 (39 percent) developed early field loss during a six- to 18-month follow-up.

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PROBLEMS ENCOUNTERED IN AN EYE CLINIC FOR CHILDREN

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There has evolved over the years a need for me to hold, at some specified time each week, a clinic for the examination under general anesthesia of infants and children having, or suspected of having, ocular pathology. At first this was necessary because of an interest in the treatment of retinoblastoma which started over 20 years ago. Then the appearance of retrolental fibroplasia increased the need. Now, I see at this clinic a great variety of lesions of infants or young children which actually runs the gamut of ocular pathology encountered in this age group.

The patients are sent for examination usually for one of the following reasons: (1) Opaque tissue or a light reflex had been noted in the pupillary area; (2) a tropia prompted an examination and some pathologic condition had been noted in the deviating eye; (3) poor fixation and the question of defective vision and its cause arose;* (4) a disparity in the size of the two eyes had been detected;† and (5) pain (glaucoma) or a congested eye had led to the appreciation of some trouble.

The clinic is conducted once a week when from six to 12 infants or children are examined under general anesthesia in a period of from one to one and a half hours. This would not be possible were it necessary to give these patients the usual type of anesthesia, which is ether, supplemented with various measures to make induction smoother. This would require admission to the hospital and all that is attendant thereto, even if the supply of beds permitted it.

We find that the use of chloroform for anesthesia makes our program possible. At a designated time each week an anesthetist is present to give the chloroform on an ambulatory basis. The method employed is reported in this issue by Dr. Herman Schwartz.[1] We have used chloroform for this light primary anesthesia for 20 years with no untoward results. The patients have a relatively smooth and quick induction. If the patient becomes too light, additional chloroform can be given without the preparations necessary when ether is used. The patients do not get obstruction from oversecretion of mucus; vomiting is rare; they awaken promptly; and they leave the hospital in 20 to 30 minutes. The anesthetist keeps a stethoscope over the precordium and any slowing of the pulse is indication not to give any more chloroform. The instillation of pontocaine into the conjunctival sac before the use of forceps to facilitate the examination enables the anesthetist to keep the patients lighter. The fact that the patients are kept light militates against aspiration.

I can recommend this type of clinic, particularly for centers where a number of ophthalmologists work. It is difficult to determine accurately the pathology present and its status from time to time in children's eyes without general anesthesia. In the past I think we have been handicapped in the diagnosis and follow-up of young children with serious eye pathology because of an inability to have an adequate examination except by admission to the hospital.

An idea of the scope of this clinic can be obtained from the following breakdown of

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* Some infants, and particularly those with subnormal vision, are slow in learning to fix their gaze on objects. This may cause concern and prompt an investigation.

† The diseased eye may be the larger one due to glaucoma but more often the smaller one shows the pathologic process. Some degree of microphthalmos may be viewed not only as a feature of congenital aberration but also of an acquired pre- or postnatal pathologic condition. It is a feature of retrolental fibroplasia and is of a greater degree in the eye more severely affected. It may be a sequela of intraocular inflammation.

the over 1,400 patients examined since the clinic started in 1947. Most of these patients have required multiple examinations.

1. Retrolental fibroplasia

Premature infants up to about the age of three months can be examined very well without anesthesia but not afterward. The infants are brought, usually, for the following reasons: (1) To determine if vision is present, and, if so, to estimate approximately how much; (2) to determine if glaucoma is present; (3) to determine if a premature infant has suffered any degree of previously unrecognized cicatricial retrolental fibroplasia; (4) to assure parents that nothing can be done to help the condition present.

2. Retinoblastoma

Examination under general anesthesia is necessary to answer the following: (1) Is the lesion present a retinoblastoma, or some other form of leukokoria?* (2) What treatment is indicated, especially if the disease is bilateral? (3) Has the treatment been effective, and is there evidence of recurrent growth? (4) Does the fellow eye show disease? If the tumor is thought to be only unilateral, the fellow eye is examined at three-month intervals for a year in case subtle intraretinal lesions were not detected. Although this tumor certainly is congenital, we find that one third of our bilateral cases had a tumor in the fellow eye overlooked at the time of enucleation.

3. Congenital anomalies of various sorts

1. Malformation of the optic nerve, including oblique insertion and inferior, superior, or nasal conus.

2. Colobomatous lesions. This would include cases of aniridia where the intraocular pressure must be watched.

3. Hydrophthalmos and follow-up after surgery, especially for tension readings.

4. Nystagmus, in an effort to rule out any intraocular pathologic process.

5. Persistent hyperplastic vitreous.[3] This lesion is seen generally for one of several reasons: first, it is more often confused with retinoblastoma than any one of the other leukokorias; second, cataract ensues and assessment of the situation from this angle is sought; third, glaucoma and secondary corneal changes occur; and fourth, an esotropia is present.

6. Hyaloid artery.

7. Retinal cyst.

8. Pupillary membrane.

9. Cataract. As reported by Guy,[3] premature infants without retrolental fibroplasia may develop a cataract in each eye which has all the clinical appearance of the so-called congenital cataract but it appears several months after birth.

10. Extensive medullated nerve fibers which may give a reflex in the pupil and be confused with retinoblastoma.

11. Colloid bodies of the disc or retina which, if extensive, may be confused with retinoblastoma, or may be a feature of tuberous sclerosis.

12. Retinal dysplasia.[4]

4. Optic atrophy

It is well know that sometimes the optic discs of infants look pale and if the babies show poor fixation the question as to whether or not an optic atrophy exists may arise. It is possible that the pale appearance of the disc is explained on the basis of late myelinization which we know normally is completed up to the lamina cribrosa several months after birth.

5. Amaurotic family idiocy (Tay-Sach's disease)

When infants do not develop normally this question sometimes arises and the appearance of the cheery-red spot of the macula may be decisive.

* This term is used to refer to the group of conditions in infants and children characterized by a white pupil and frequently called pseudoretinoblastoma.

6. Angiomatous lesions

These are more often of the skin but when the lids are involved the lesion may also extend into the orbit. Twenty percent of these skin hemangiomas of infants, often referred to as strawberry angiomas, are present at birth and 80 percent appear within the first five weeks after birth. They usually increase in size for from six to eight months and then show, without treatment, a regression which is usually complete within five years. The incidence of these lesions in our premature nursery on the low oxygen regimen has shown a striking decrease.

Also belonging to this group are the cases of Coats' disease, telangiectasis of the retina, Sturge-Weber disease, and angiomatosis retinae (von Hippel-Lindau).

7. Massive retinal fibrosis[9]

We know that retinal hemorrhages are common in the newborn at the time of birth. Sometimes such a hemorrhage in the retina is massive in nature just as it may be in the brain. As a result, in the eye, it leads to organization and the occurrence of a white mass of tissue which may have to be differentiated from retinoblastoma.

8. Various rare tumors

Besides the retinoblastoma and hemangioma previously mentioned, under this heading would be, (1) Astrocytoma, or glioma, of the optic nerve which may be a feature of early neurofibromatosis; (2) neurofibromatosis involving the orbital tissues (café-au-lait pigmentation of the skin may be the earliest manifestation of neurofibromatosis); (3) neuroblastoma which more often is metastatic to the orbit from a manifest or occult tumor involving the suprarenal gland; (4) sarcomas from the eye adnexa and particularly rhabdomyosarcoma and embryonal rhabdomyoma; (5) leukemia, manifesting itself as an expanding lesion around the eye.

9. Inflammatory or postinflammatory conditions

These fall in the following groups:

First, granulomatous uveitis is conceivably due to toxoplasmosis, tuberculosis, or any of the granulomatous diseases.

Second, metastatic retinitis occurring at the time of any systemic infection of infancy and childhood. Characteristically, the lesion goes unapprehended at its inception during the active infection but is detected much later as a leukokoria when organization, contracture, and retinal detachment ensue.

Third, nematode endophthalmitis which I have not been able to more than suspect.

No doubt all three of the above conditions may lead to the same end-stage. This is an atrophic globe with opaque tissue back of the lens which may be partially or totally cataractous, or the eye may be atrophic following a period of glaucoma which produced some buphthalmos, or the lesion may be seen in the stage of buphthalmos with nondescript tissue back of a clear or partially opaque lens.

Fourth, opaque corneas. These are bilateral and present at birth. Further characteristics are (a) a round, central, dense corneal opacity; (b) the tonometer registers an elevated tension but to palpation the tension seems normal. These changes are thought to be the result of intrauterine corneal ulceration or the manifestation of an intrauterine keratomalacea.

10. Unclassified

Sometimes secondary changes mask the primary pathology in the eye so that the nature of the basic lesion can not be determined. We may see, therefore, one of the following two terminal pictures which defy further classification:

First, clouding of the vitreous with or without a clouded lens and cornea. The question may arise as to whether or not we are dealing primarily with a hemorrhagic, exudative, or neoplastic process.

Second, retinal detachment with acquired tissue over the surface of the retina or in the vitreous.

The two groups above may be further complicated by glaucoma with or without buphthalmos or by atrophy of the globe.

SUMMARY

The advantages of having available the facilities for examining babies and children under general anesthesia on an ambulatory basis are discussed. For this, chloroform has proven to be a satisfactory anesthesia and the method employed is given in a report in this issue. A break-down of the types of cases examined in our clinic during the past eight years is given.

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CHLOROFORM ANESTHESIA FOR OPHTHALMIC EXAMINATION*

A USEFUL TECHNIQUE FOR AMBULATORY CHILDREN

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Careful examination of the eyes of infants and children under the age of three or four necessitates the use of general anesthesia. It is the purpose of this paper to discuss the problems of general anesthesia for ambulatory children and to present the details (with some modifications) of a useful and safe technique using chloroform described originally by Martin and Reese in 1945.[1] Since 1947 over 3,200 ophthalmic examinations have been performed at the Institute of Ophthalmology of the Columbia-Presbyterian Medical Center with this method without serious sequelae. There were no deaths or any postanesthetic liver, kidney, or respiratory complications. These excellent results do not imply that the potential hazards of chloroform are unimportant. They exist, but can be eliminated or minimized by careful attention to details which will be described. Even the specialist in anesthesiology, if he is unfamiliar with chloroform, must approach this method cautiously to master its intricacies without danger to patients.

The objectives of general anesthesia for these ophthalmic patients may be listed as follows:

1. Safe and efficient production of anesthesia.

2. Nonexplosive agents and methods.

3. Quick induction and fast recovery from anesthesia because of the ambulatory status of the patients. However, the recovery should be gradual enough after administration is discontinued to allow five to 15 minutes for examination of the eyes.

4. Avoidance of salivation and vomiting in these unpremedicated patients.

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5. A minimum of psychic trauma to the child because of the need for repeated examinations.

The technique which will be described based upon the use of chloroform fulfills the first three objectives satisfactorily. The fourth objective is usually accomplished, but the fifth objective is rarely attained.

It is realized that exception is traditionally taken to the concept that chloroform can be given with little danger. Waters and his associates[2] published the findings of an extensive study of the drug in 1951 and stated that "fear and distrust based on incomplete knowledge and misconceptions have engendered a present disuse of this agent which seems all out of proportion to the facts." They showed primarily that chloroform was a safe drug if certain conditions were fulfilled:

1. Prompt diagnosis and immediate therapy of early physiologic changes which can be produced by overdose of chloroform are essential. There are the bradycardia and arrhythmias of myocardial depression.

2. A free airway and adequate oxygenation must always be maintained with suitable inhalation equipment. Appropriate methods and clinical skills for efficient ventilation should be immediately available.

3. It is realized that chloroform is a very potent drug and that haste and impatience resulting in administration of high concentrations is very dangerous.

If these rules are followed, Waters could not demonstrate that the incidence of serious complications was higher with chloroform than with any other anesthetic agent.

Technique

The eye examinations are performed in the morning. The only preparation required of the parents is to see to it that no solid food nor milk is ingested by the child after 2:00 A.M. of the morning of the examination. Fluids (tea, sugar water, ginger ale, orange juice) are permitted until 6:00 A.M. To be certain that these orders are understood, detailed typed instructions are given to the parents at the time the appointment is made (fig. 1).

THE PRESBYTERIAN HOSPITAL
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COLUMBIA-PRESBYTERIAN MEDICAL CENTER
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INSTRUCTIONS

PREPARATION OF INFANTS AND CHILDREN FOR EXAMINATION UNDER ANESTHESIA IN THE RADIOTHERAPY DEPARTMENT OF THE INSTITUTE OF OPHTHALMOLOGY

The patient must not take any solid food nor milk by mouth after 2:00 A.M. on the morning of the examination. Fluids (tea, sugar water, ginger ale, orange juice) may be given until 6:00 A.M.

If the child has a cold, fever, vomiting, or has not fully recovered from a recent illness, please notify your eye doctor at the Columbia-Presbyterian Medical Center before leaving home so as to arrange for a substitute appointment if necessary.

If there is any question about the patient's condition, a letter of clearance for anesthesia is required from the family doctor or pediatrician.

M.D.
Anesthesiology Service

Fig. 1 (Schwartz). Detailed instructions are given to the parent at the time the appointment is made.

The patients are brought into the clinic about one hour before the scheduled time of examination and the pupils dilated with 10-percent neosynephrine and five-percent homatropine, if there is no contraindication, before anesthesia is begun. A stethoscope is secured on the child's precordium for continuous ausculation of the heart rate and rhythm by the anesthesiologist.

An open drop mask is saturated with chloroform and the bottle placed out of reach of the administrator to avoid the temptation of adding any more drug. Oxygen is allowed to flow under the mask at the rate of 500 cc. or more per minute to insure an adequate oxygen content in the inspired air.[3] Since chloroform vapor is heavy (specific gravity = 4.1), the mask can be held about six to 12 inches above the child's face and still produce sleep. The mask is lowered gradually to the child's face. Only about three to five minutes of chloroform anesthesia are required, as a rule, before the patient is adequately anesthetized for ophthalmoscopy. Fixation of the eyeballs or complete relaxation of the arms are used as end-points.

However, if bradycardia (pulse under 80 per minute) or arrhythmia are produced at any time during the induction, the mask is immediately removed until the heart rate and rhythm have returned to normal before continuing.

When the end-point is reached a few drops of one-half percent tetracaine are instilled into each eye for topical anesthesia of the conjunctiva, the mask is completely removed and the ophthalmic examination performed. Usually the child will stay asleep for five to 10-minutes. If the patient awakens during the examination, he can be reanesthetized quickly by adding a few drops of chloroform to a dry mask until the desired level is again attained. The use of tetracaine to eliminate painful stimulation of the conjunctiva when it is grasped with a forceps serves to prolong the time during which useful working conditions will prevail. Usually within 10 minutes after the examination is completed the child is fully awake and can be taken home.

Discussion

The technique as described has been used for over 3,200 eye examinations in an eight-year period without any serious mishaps. This established this method as a safe one, *if the rules listed above are followed.*

Chloroform is a very potent drug. Only 0.5 percent to 1.0 percent is needed in the inhaled atmosphere to produce anesthesia. This marked potency is taken into consideration during the induction, as the child will frequently get deeper for 30 to 60 seconds after the mask has been removed. This can probably be explained by a rising blood concentration as a result of absorbing that chloroform vapor which was primarily present in the pharynx, trachea, and bronchi. The administration is stopped therefore a little before adequate anesthesia has been established.

Constant monitoring of the heart beat is essential. Bradycardia usually occurs suddenly. It can result not only from overdose of chloroform but also as a consequence of breath holding by the child. However, therapy for either situation is the same, removing the mask from the face of the patient. If the bradycardia is due to breath holding, the pulse rate will increase immediately when the next inspiration occurs; if it is due to depression of the myocardium by the drug, it will usually continue for a minute or two longer.

Occasionally bradycardia has been produced by pressure on the eyeball during manipulation of the eye. Immediate release of this pressure remedies this situation. It is probably a result of an oculovagal reflex and is seen with other anesthetic techniques.

The importance of immediately available resuscitative equipment cannot be overstressed. In the past year, three instances of respiratory arrest occurred. There was associated a feeble and slow heart beat. Immediate artificial respiration with a mask and a bag with 100-percent oxygen produced an improved pulse and return of respiration within 60 seconds. In every instance the overdose occurred as the child was being reanesthetized because there was more than one examiner or the examination took longer than usual. The impatience of the anesthesiologist to re-establish anesthesia resulted in administering too much chloroform too quickly. When the subject has to be put back to sleep, it must be remembered that some chloroform is already present in the blood. Less is needed than during the initial induction, and overdose is easier to produce. Therefore, a dry mask should be used and chloroform added slowly and more gradually at this point.

The one serious disadvantage of this technique is the psychic trauma to the child. These patients are unpremedicated, may be hungry, and frightened, and are taken directly from the protective arms of their parents to be anesthetized. Since most are under three years of age, reasoning with them to obtain their co-operation is difficult. Unfortunately they must often be restrained for the induction. However, it is felt that

the other advantages of the technique considerably outweigh this disadvantage.

Summary

A technique for anesthetizing ambulatory children for eye examinations using chloroform anesthesia has been presented. Over 3,200 patients were anesthetized using this method with no serious complications. The advantages and the disadvantages of this technique were reviewed. The precautions required to preserve safety of the method have been emphasized.

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I acknowledge, with gratitude, the help of Dr. Frederick Spitzhoff in compiling the data for this paper.

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RESULTS FROM PREDNISOLONE THERAPY*

In primary inflammatory conditions and postoperative complications of the eye

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One of the most recent hydrocortisone derivatives is prednisolone which is the delta-1 analogue of hydrocortisone. Its therapeutic activity is similar to hydrocortisone; however, its anti-inflammatory action is more than three to five times that of hydrocortisone. This is a report on the local use of prednisolone in various inflammatory eye conditions, both primary and postoperative. Although other reports[1-5] have appeared in the literature on the use of prednisolone in ophthalmology, little has been written about the use of this drug in the treatment of postoperative complications in ophthalmic surgery. I am reporting this series of cases with particular emphasis on this group of conditions in which we have observed favorable results.

Method

Prednisolone† in the form of a bland ointment preparation was used. The ointment base was composed of 40-percent liquid petrolatum and 60-percent white vaseline. This was prepared in two strengths, 0.25 and 0.5 percent.

A small amount of the ointment was instilled into the lower cul-de-sac of the affected eye three or four times daily. The ointment was used only once daily in the eyes of postoperative corneal transplants while the eye was still being dressed. After the eye was left open, the drug was applied to the eye twice daily. An antibiotic was always used in conjunction with prednisolone in these cases.

Duration of treatment with this drug varied from one week to seven months. The patients were observed at regular intervals during the period of treatment.

Comments

Table 1 lists a total of 51 cases treated

* From McPherson Hospital.

† Prednisolone was supplied by the courtesy of Chas. Pfizer & Co., Inc., New York.

locally with prednisolone ointment. Forty of these were improved by this therapy; 10 were unimproved. One case was inconclusive. In Table 2 these cases are classified under the various primary inflammatory eye conditions. Table 3 lists the postoperative inflammatory eye conditions treated with prednisolone. The results in each group of cases as outlined in Tables 2 and 3 are discussed in more detail in the following paragraphs.

Primary inflammatory eye conditions

1. *Nongranulomatous uveitis* was more responsive to prednisolone therapy than granulomatous uveitis. In every case of nongranulomatous uveitis the anterior segment was mainly involved.

There was one case of sympathetic ophthalmia, which had a relapse with evidence of much anterior segment disease. This showed marked improvement with the local use of prednisolone ointment.

Three cases of granulomatous uveitis with posterior segment disease did not respond to treatment with topical prednisolone. The local use of prednisolone was combined with atropine in all those cases of uveitis with anterior segment involvement.

2. *One case of severe traumatic iritis* responded rapidly to topical prednisolone therapy.

3. *All of the cases of allergic conjunctivitis* except one responded to prednisolone therapy. Two of these had become refractory to all other forms of treatment, including other steroids. It was thought that one case did not improve because of hypersensitivity to the ointment base. The condition immediately respon[illegible] to treatment after substitution of another prednisolone preparation in the form of drops.

4. *One case of phlyctenular keratitis* failed to improve on prednisolone ointment but did improve on prednisolone drops. Two cases of bullous keratitis secondary to Fuchs' dystrophy did not improve on prednisolone.

5. *One case of chronic bilateral keratoconjunctivitis* was associated with severe intermittent atopic dermatitis. This condition had become refractory to treatment with cortisone, hydrocortisone drops and ointment, and cortisone-antihistamine combinations used locally. There was immediate response to prednisolone therapy, and no relapse has occurred during the seven months of therapy with this drug.

Another case of severe bilateral chronic keratoconjunctivitis followed mumps. This condition became refractory to all local cortisone and hydrocortisone preparations. The vision in both eyes was greatly impaired. The keratoconjunctivitis rapidly subsided on prednisolone therapy. There was a relapse on discontinuing the drug temporarily, but immediate improvement occurred on resuming prednisolone therapy. The patient has been treated with the drug for six months.

The only serious complication that resulted from the use of local prednisolone ointment was a dendritic ulcer which appeared in a case of nongranulomatous uveitis after the drug had been used for a month. In several other cases a mild superficial punctate keratitis resulted. This was never severe enough to discontinue the drug. The cornea soon became clear when treatment was discontinued.

Postoperative inflammatory eye conditions

1. *There were three cases of severe postoperative uveitis* following glaucoma surgery. Prednisolone was equally as effective as hydrocortisone and better than cortisone in the treatment of these cases.

2. *There was one case of uveitis* and two cases of corneal edema following cataract surgery which had been treated locally with both cortisone or hydrocortisone drops and ointment. This treatment had resulted in little or no improvement. Prednisolone therapy produced no appreciable improvement in vision, but in every case the eye became less irritated and more comfortable. This improvement was apparently greater than

TABLE 1

LIST OF CASES TREATED WITH TOPICAL PREDNISOLONE OINTMENT

Diagnosis	Prednisolone		Result	Remarks
	0.25%	0.5%		
1. Nongranulomatous uveitis O.S. with secondary glaucoma	x	x	Improved	Uveitis and secondary glaucoma improved. Developed dendritic ulcer O.S. after approximately one month's use.
2. Phlyctenular keratitis O.U.	x		Not improved	No improvement on prednisolone ointment after 10 days' therapy. Improved on prednisolone drops.
3. Allergic conjunctivitis O.U.	x		Good	Prednisolone gave immediate improvement. No previous steroid therapy.
4. Pterygium (excision) O.S.	x		Good	Prednisolone used for one month postoperatively. Reaction of eye minimal. No recurrence four months after excision.
5. Corneal edema and vascularization following corneal transplant O.D. for corneal scar.		x	Good	Mushroom graft. Stopped vascularization. Corneal edema cleared.
6. Secondary glaucoma. Corneal edema following extracapsular cataract extraction O.D.	x		Improved	Had cyclodialysis O.D. freeing vitreous from cornea. Glaucoma controlled. Prednisolone used postoperatively for two months. Cornea completely clear at that time.
7. Corneal edema following corneal transplant O.S. for corneal scar	x	x	Improved	Cleared corneal edema which was unimproved by hydrocortisone.
8. Bullous keratitis following cataract extraction O.D.	x		Not improved	Still had bullous keratitis two weeks after use of prednisolone.
9. Intermittent corneal edema, confined mainly to stroma and epithelium	x	x	Not improved	Not improved by any previous therapy. No improvement noted after two weeks on prednisolone therapy.
10. Corneal edema following corneal transplant O.D. for Fuchs' dystrophy	x		Improved	Graft stayed edematous in spite of the use of Diamox and hydrocortisone. Cleared promptly on prednisolone.
11. Recurrent pterygium O.D.	x		Good	Eye clear six months postoperatively. Had beta radium following first procedure.
12. Corneal edema following corneal transplant O.S. for corneal scar		x	Good	Irritation subsided on prednisolone. Corneal edema cleared.
13. Bullous keratitis following corneal transplant O.D. for Fuchs' dystrophy	x		Improved	Bullous keratitis influenced more favorably than by hydrocortisone.
14. Recurrent pterygium O.D.		x	Good	No recurrence five months postoperatively.
15. Vernal conjunctivitis (palpebral) O.U.	x		Good	Previous beta radiation given to lids for papillary hypertrophy.
16. Vernal conjunctivitis (limbal) O.U.	x		Good	Eyes completely clear after two weeks of treatment with prednisolone.

TABLE 1—(*continued*)

Diagnosis	Prednisolone 0.25%	Prednisolone 0.5%	Result	Remarks
17. Acute nongranulomatous uveitis O.D.	x		Excellent	Anterior chamber clear after two weeks of prednisolone therapy.
18. Bullous keratitis O.U. Advanced Fuchs' dystrophy	x	x	Not improved	Prednisolone had no effect.
19. Allergic conjunctivitis O.U.	x		Improved	Failed to improve on 2.5% hydrocortisone drops and systemic pyribenzamine. Improved on prednisolone therapy.
20. Granulomatous uveitis, with corneal edema O.S.	x		Not improved	Prednisolone used with diamox. Posterior segment not improved.
21. Keratoconjunctivitis O.U.	x	x	Excellent	Has recurrent attacks of atopic dermatitis. Eye condition refractory to treatment with cortisone and 2.5% hydrocortisone. Has been using prednisolone for seven months.
22. Edema of corneal graft O.D. following cataract extraction	x	x	Good	Corneal edema cleared on prednisolone.
23. Corneal edema following corneal transplant O.D. for Fuchs' dystrophy	x		Not improved	Cataract removed at time of corneal grafting. Diamox used postoperatively. Unimproved by prednisolone.
24. Corneal edema following corneal transplant O.S. for keratoconus	x		Good	Corneal edema cleared on prednisolone.
25. Bullous keratitis O.D.	x		Not improved	
26. Corneal edema following cataract extraction O.D.		x	Improved	Cataract extraction complicated by vitreous loss. Irritated eye made more comfortable with prednisolone.
27. Chronic keratoconjunctivitis O.U.	x	x	Excellent	Keratoconjunctivitis O.U. followed mumps. Had become refractory to all previous steroid therapy.
28. Corneal edema postoperative to corneal transplant for severe bullous keratitis O.S. occurring after catract extraction	x	x	Improved	Edema of corneal graft not improved by hydrocortisone. Improved after prednisolone.
29. Allergic conjunctivitis O.U.	x		Good	Condition refractory to other steroid and antihistamine therapy. Prednisolone produced immediate improvement.
30. Superficial keratitis following cataract extraction O.S.	x		Not improved	Eye clinically improved on prednisolone therapy. Patient continued to complain of discomfort.
31. Corneal edema following corneal graft O.S.	x		Improved	2.5% hydrocortisone did not clear edema of graft. Definitely improved by prednisolone.
32. Uveitis following cataract extraction O.D. complicated by loss of vitreous	x		Improved	Eye quiet six weeks postoperatively, following use of prednisolone.
33. Corneal edema following corneal transplant O.D. for corneal scar	x		Inconclusive	Corneal edema improved by use of prednisolone in conjunction with Diamox.

TABLE 1—(*continued*)

Diagnosis	Prednisolone 0.25%	Prednisolone 0.5%	Result	Remarks
34. Corneal edema following corneal transplant O.D. for corneal scar	x		Improved	No improvement on Diamox. Corneal edema and vascularization definitely improved on prednisolone.
35. Nongranulomatous uveitis O.S.	x		Not improved	Necessary to give systemic prednisolone in addition to topical treatment with prednisolone. Posterior segment unimproved.
36. Severe postoperative iritis O.U. following postoperative iridencleisis O.U. for acute glaucoma	x	x	Good	Marked improvement on prednisolone therapy. Used for three months.
37. Blind O.S. Old chronic uveitis O.D. (severe diabetic)	x	x	Good, O.D.	Inflammation O.D. subsided on prednisolone. Blind left eye removed because of uncontrolled glaucoma. Has been using prednisolone for five months.
38. Severe postoperative uveitis O.S. following cataract extraction	x	x	Improved	With 2.5% hydrocortisone drops, eye still irritated. Eye became quiet on prednisolone therapy.
39. Severe postoperative iritis O.D. following iridencleisis for chronic glaucoma	x		Good	First treated with cortisone and hydrocortisone. Response of eye to prednisolone superior to cortisone and hydrocortisone.
40. Corneal edema following corneal transplant O.D. for corneal scar	x		Improved	Also given Diamox with prednisolone. Improvement with prednisolone noted prior to use of Diamox.
41. Corneal edema following corneal transplant O.U. for keratoconus	x		Improved	Bullous keratitis which had not responded to hydrocortisone improved on prednisolone.
42. Allergic conjunctivitis O.U.	x		Not improved	
43. Sympathetic ophthalmia O.S. with relapse	x		Improved	Anterior chamber clear and eye quiet after using prednisolone six weeks.
44. Allergic conjunctivitis O.U.	x		Improved	Eye much clearer and comfortable after using prednisolone.
45. Allergic conjunctivitis O.U.	x		Excellent	Prednisolone gave immediate results. No previous steroid therapy.
46. Old deep and superficial keratitis secondary to chemical burns O.U.	x		Improved	Eyes showed marked improvement with less injection and complete disappearance of photophobia after two weeks' treatment.
47. Uveitis O.S. granulomatous	x		Not improved	Some questionable improvement of anterior segment. Posterior segment not improved. Treated six weeks.
48. Severe intraocular hemorrhage following cataract extraction O.S.	x		Improved	Eye markedly improved and without irritation one month postoperatively.
49. Keratoconjunctivitis following mumps O.U.	x		Good	Marked improvement after one week's prednisolone therapy.
50. Severe traumatic iritis O.S.	x		Excellent	Eye quiet after using prednisolone therapy for one week.
51. Superficial punctate keratitis O.U.	x		Good	Used with antibiotics. Eyes completely clear after two weeks of prednisolone therapy.

TABLE 2

PRIMARY INFLAMMATORY EYE CONDITIONS

Diagnosis	Number of Cases	Improved	Not Improved	Complications
1. *Uveitis*				
Granulomatous	3		3	One case of nongranulomatous uveitis developed a dendritic ulcer after one month's therapy with prednisolone.
Nongranulomatous	4	4		
2. *Traumatic iritis*	1	1		
3. *Allergic conjunctivitis*	8	7	1	
4. *Keratitis*				
Phlyctenular	1		1	
Superficial	1	1		
Bullous (secondary to Fuchs' dystrophy)	2		2	
Superficial and deep (secondary to chemical burn)	1	1		
Unclassified	1		1	
5. *Chronic keratoconjunctivitis*	3	3		
TOTAL CASES	25	17	8	

had been obtained with either local cortisone or hydrocortisone therapy.

3. *The drug was used in a group of 14 corneal transplantations* in an effort to reduce edema of the graft. In one case no improvement was noted. Three cases improved promptly after receiving prednisolone. Eight cases of corneal edema which had been unsuccessfully treated with hydrocortisone or Diamox, or a combination of the two, improved immediately after treatment with prednisolone was instituted. In one case, the cause of the favorable result was not determined conclusively because Diamox, which is known to reduce corneal edema,[6] had been administered at the same time. In one case the drug seemed to inhibit a tendency to vascularization.

4. *One case of pterygium excision* was treated postoperatively with topical prednisolone. There was surprisingly little reaction during the entire postoperative course.

TABLE 3

POSTOPERATIVE INFLAMMATORY EYE CONDITIONS

Diagnosis	No. of Cases	Improved	Not Improved	Inconclusive
1. Postoperative uveitis (glaucoma surgery)	3	3		
2. (a) Postoperative uveitis–cataract surgery)	1	1		
(b) Corneal edema following cataract surgery	2	2		
3. Corneal edema following postoperative corneal transplant	14	12	1	1
4. Pterygium (excision)	1	1		
Recurrent pterygium	2	2		
5. Postoperative intraocular hemorrhage	1	1		
6. Postoperative keratitis	2	1	1	
TOTAL CASES	26	23	2	1

Two cases of recurrent pterygium treated postoperatively with prednisolone showed a quiet eye five months and six months after surgery without evidence of recurrence. One of these had been given Beta radiation for recurrence following the initial excision.

5. *One case of severe intraocular hemorrhage* followed cataract extraction. Because of the marked postoperative irritation and discomfort, enucleation was considered prior to the topical use of prednisolone. It was felt that the use of this drug made the removal of the eye unnecessary.

6. *Two cases of superficial keratitis* followed cataract surgery. One of these was a bullous keratitis which responded promptly to prednisolone therapy. The other case was one of superficial punctate keratitis. This showed evidence of visible improvement on prednisolone therapy; however, the patient stated that the eye still was uncomfortable.

No serious complications resulted from the use of prednisolone in the above postoperative eye conditions.

No difference was noted in the degree of response obtained from the 0.25-percent and 0.5-percent prednisolone preparations in each group of cases.

Summary

1. The same precautions should be observed with the local use of prednisolone as with other steroids.

2. Various inflammatory and postoperative eye conditions, which had failed to respond to or had become refractory to other forms of steroid therapy, responded to topical prednisolone.

3. Inflammatory conditions of the anterior segment responded well to topical prednisolone therapy. Inflammatory conditions of the posterior segment responded poorly.

4. Corneal edema after keratoplasty seemed to respond better to prednisolone than to either cortisone or hydrocortisone.

5. Allergic conditions showed the best response to prednisolone.

6. It is felt that prednisolone is the most valuable steroid for topical use.

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EXOPHTHALMOMETRY*

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INTRODUCTION

In 1936 Howard C. Naffziger, of San Francisco, gave an address before the Saint Louis Medical Society on malignant exophthalmos. He closed his address with an eloquent plea for a simple reliable exophthalmometer. Not knowing anything about the formidable literature on the subject, and indeed knowing only about the practical use of the Hertel, I decided to try to fill this need. I enlisted the aid of Mr. J. L. Forrest of Erker Bros. Optical Co., Saint Louis, who made up the first very rough exophthalmometer according to my specifications (fig. 1).

I tried to obtain fair parallelism of visual line and vertical axis through the lateral rim of the orbit, by having the patient look through two five-mm. apertures placed 75 mm. before each eye. This apparatus used a small sighting device which slid along the ruler to insure a measurement made at right angles to the ruler. It was discarded after the first series of measurements.

I tried the Hertel, mine, and a simple ruler on about 25 individuals and made around 20 measurements with each one on each person, all at widely different times, and using first one and then another piece of apparatus. Each person was told his Hertel interorbital distance so that the instrument was set for the exact same distance each time. Otherwise no reference to any previous measurements was made. When I compared my results I found that in my hands the ordinary ruler gave definitely more repeatable results. Long before that I had decided it was easier to use.

When I told him about my figures, Mr. Forrest then told me that my preceptor, W. H. Luedde, had him working on an exophthalmometer which would use the bridge of the nose as a fixed reference point, with a Hertel-like mirror system to sight the cornea and a rule. I showed my results to Luedde. He added the very ingenious idea of making the ruler of clear thick plastic with the cm. markings on both sides so that, if the sighting was done properly, the cm. markings appeared superimposed. The Luedde exophthalmometer resulted. It is described under technique.

DEFINITIONS

Exophthalmos denotes the vertical distance in mm. that the apex of the cornea stands in front of the compressed skin over the most posterior part of the lateral orbital rim when the eyes are looking straight ahead, or in "eyes front" position. Schoenberg[1] is one of the few who defined this term carefully, as "the number of mm. the cornea is in front of the plane passing through the anterior border of the temporal

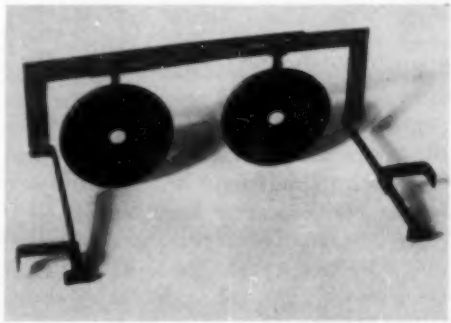

Fig. 1 (Drews). Drews experimental exophthalmometer, 1936.

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wall of both orbits." However, this definition is likely to give rise to the idea that only the transverse line through the lateral orbital rim is important; this is correct only if the lateral orbital rims are equidistant from the hypothetic frontal plane. If we could accept Schoenberg's definition the Hertel measurements would far more closely approximate the correct value.

Exophthalmos could mean how much farther the eye protrudes from the socket than it should. This ideal measurement usually is called *absolute exophthalmos* but any attempts at its definition are very rare indeed. We cannot measure absolute exophthalmos clinically because so many unmeasurable factors determine this position, such as size, height, and capacity of the orbit, length of the eye, volume of intraorbital contents, and so on. Birch-Hirschfeld,[14] paragraph 23, defines absolute exophthalmos as the difference between the level of the cornea and a point on the orbital rim. We can come very close indeed to this measurement.

One cannot define exophthalmos in relation to the frontal plane of the face because this plane cannot be determined. It is this reference plane which we try to use when we try to estimate exophthalmos by using our depth perception or by simply looking at the patient. With all modern apparatus how far the eyes stand forward is not the question at all; the question is how far in front of the lateral orbital rims do they stand.

By *relative exophthalmos* we mean the relative position of the two corneas in relation to the lateral orbital rims. If by relative one means the position of the two corneas in relation to the frontal or face plane then relative position cannot be measured.

By *comparative exophthalmos* we mean comparing the exophthalmos of the right eye with the right and the left eye with the left at various times.

Most of those who use the Hertel choose to define exophthalmos as the measurement obtained with the instrument. This is comparable to "intraocular pressure, Schiøtz," but its limitations are not nearly so well understood.

When exophthalmos measures less than 10 to 12 mm. there is said to be *enophthalmos*. Schoenberg[1] called his instrument exophthalmometer and enophthalmometer but this exactness seems scarcely necessary. Wagener[2] gave his series of exophthalmos measurements in a paper on enophthalmos. Most exophthalmometers can measure enophthalmos unless it is unusually severe.

History of Exophthalmometry.

Cohn

In 1865, Cohn[3] of Breslau published the first article on exophthalmometry. He made a special instrument and measured from the lateral orbital rim. He proposed the name ophthalmoprostatometer, but shortly afterward he coined the name *exophthalmometer*. In 1867, Cohn[4] brought out a very complicated instrument designed to measure exophthalmos from the superior orbital rim, vertically above the pupil, with "eyes front" (fig. 2). The reason why the originator of exophthalmometry changed from the lateral orbital rim to the superior orbital rim may be of some interest:

> Soon I found out that this apparatus (1865) offered many difficulties due to the variability of facial contours and sensitivity of the eyeball and certain skin nerves. The easiest would be to place a ruler on the lateral orbital rim in a plane parallel to the nasal septum and perpendicular to the orbit itself; to move a metal plate attached to the ruler at right angles until it touched the closed eyelid over the cornea. This proved to be poor first because of the variability in thickness of the lid and second because it is quite difficult to maintain the ruler in a plane perfectly parallel to the nasal septum, and minor variations in this position influenced the results considerably.
>
> The first difficulty I overcame by placing a telescope on the ruler; then I made sure of the correct position of the ruler by using the forehead as a base with a headband to which the ruler was attached by a three dimensional screw system. However, I soon found out that the lateral rim of the orbit was quite sensitive to pressure so I constructed an instrument in which the ruler was not pressed

Fig. 2 (Drews). Cohn's illustration of his last instrument.

against the lateral rim of the orbit at all except for a moment to place it correctly.

Several hundred measurements done in normal eyes by this means showed a prominence of 10-18 mm. from the lateral rim of the orbit; some strongly myopic eyes went up to 24 mm. These observations were confirmed by a series of measurements on a series of skulls. They showed that the most prominent (forward) point on the lateral orbital rim is only very rarely equidistant from an ideal plane passing perpendicularly through both mastoid processes. Therefore a comparison of the prominence of the two eyes could not be made due to the asymmetry of the two lateral orbital rims. Furthermore, a more accurate observation will evidence that the physionomic expression of staring depends more on the superior orbital rim than on the lateral orbital rim. These considerations made me choose the superior orbital rim for punctum fixum in spite of the fact that I knew that the skin over the lateral orbital rim is very thin. In fact in an obese female of 270 pounds who used to exhibit herself in Breslau, the lateral orbital rim had no fat at all.

Then Cohn apparently discarded the lateral orbital rim because of asymmetry, and sensitivity to pressure, without even attempting to compare the asymmetries of the superior orbital rim to those of the lateral orbital rim. In addition he states that the superior orbital rim has variable hair, and variable skin and fat pad. But he states, "We are used to see the eye overshaded and overreached by the supraorbital margin and we are used to interpret any protrusion beyond this rim as an unusual finding and call it a stare." (The term stare was not differentiated from exophthalmos until 50 years later.) Now it seems to us his reasons for changing from lateral orbital rim to superior orbital rim are very poor.

Cohn presented a very complicated instrument designed to use the superior orbital rim for punctum fixum, with even a small plumb line so that one could be sure it was held vertically. He states that he "will concede that the correct position of the head is difficult but that incorrect head positioning will produce an error of not more than one mm. which seems acceptable." With this instrument he measured 427 patients of all ages and refractive states, and found the prominence to vary between −10 mm. and +12 mm., a range of 22 mm. He found only 74 persons with the same measurement for each eye; in the remaining 345 the difference varied from 0.5 to 8.0 mm. "Differences of 1-3 mm. are quite common even in perfectly normal individuals." He does not state that over three mm. should be considered abnormal.

Emmert

In 1870, Emmert[5] reported a very simple apparatus consisting of a small metal plate which is held against the side of the patient's face with its posterior edge near the mandibular joint (fig. 3). A fixed rod ex-

Fig. 3 (Drews) Emmert's illustration of his instrument.

tends forward from the plate, and two rods which slide freely extend at right angles to this fixed rod. One rod is used to locate the position of the lateral rim of the orbit. On the extremities of the other rod are two sharp points two mm. high. This rod is placed so that one point is medial to the cornea and the rod is then so adjusted that the two points are seen in line with the apex of the cornea. He states:

"To be able to attain mathematically perfect results with my apparatus it is *necessary* to maintain the plate and rod perfectly parallel to the median plane of the head. As till today it has been impossible to determine the median plane of every head, it follows that it is impossible to set the instrument perfectly."

Emmert categorically rejected Cohn's reasons for shifting from lateral rim of the orbit to superior rim of the orbit. In 1880 he published a monograph[6] on anthropologic measurements of the orbit. However in this monograph he did not even mention the problem of cranial asymmetry in exophthalmometry.

Zehender

In the same journal, immediately after Emmert's article there follows an article by Zehender[7] entitled "One more new exophthalmometer" (fig. 4). He placed a mirror medial to the cornea and parallel to his ruler. He obtained a perfectly perpendicular sighting by marking the center of the mirror and placing a sighting device exactly opposite this center lateral to the ruler. When the sighting device was seen in the center of the mirror one was certain that the sighting was done perpendicularly. He also secured proper fixation by having the patient look into another marked mirror placed before the eye. While the title of this paper is disarming the "still another exophthalmometer" was a real fundamental advance. Of all the instruments of the past it alone seems worthy of trial now.

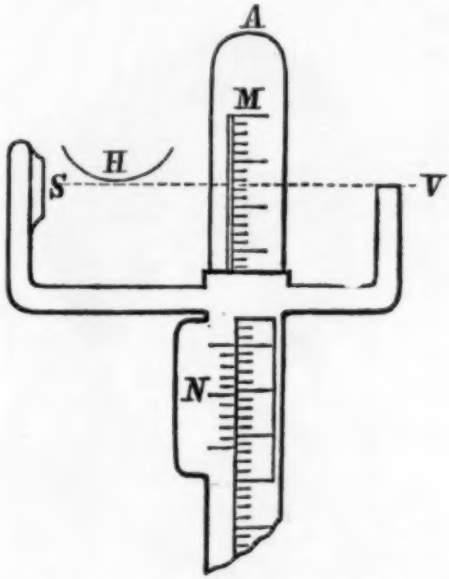

Fig. 4 (Drews). Zehender's illustration of his instrument.

Keyser

Also in 1870 P. Keyser,[8] of Philadelphia, described an instrument which has some similarities to Emmert's but without his excellent sighting device (fig. 5). He states that:

"In many if not most persons the two sides of the face are not equal, one is more prominent than the other so that one eye seems more prominent. But as we only want to know how much the eye protrudes over the foramen orbitale it does not matter whether the two lateral orbital rims are in the same alignment, this is guided by the center of the face. . . . I have measured many

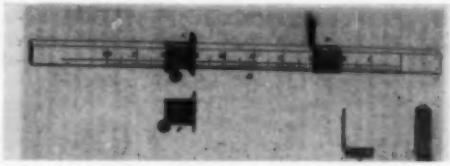

Fig. 5 (Drews). Keyser's illustration of his instrument.

skulls and found that the superior orbital rim is as irregular as the lateral orbital rim. In no skull did I find the mastoid process in the same alignment on both sides, so one cannot gain a correct baseline from them (contrary to Cohn). However, if one measures from the tuberculum of the temporal bone, or from a line which passes through the middle of both fossae glenoidalis one finds the two sides of the skull are almost if not exactly the same."

Birch-Hirschfeld

Birch-Hirschfeld of Leipzig[9] reported in 1900 on the use of a formidable instrument made by Sattler and Hering (figs. 6 and 7). This was a double telescope device with a chinrest and stand. Two observers working together could measure each eye simultaneously if desired. The instrument looks about as complex and expensive as a slit-lamp, and cost 225 marks (Hertel[16]). He emphasized that since the lateral orbital rim "has considerable individual variations in its position . . . the instrument is of value chiefly for comparative measurements on the same person at various times." He is the first to present actual data to show that his measurements are repeatable.

Fig. 6 (Drews). Birch-Hirschfeld's illustration of the Satler and Hering instrument.

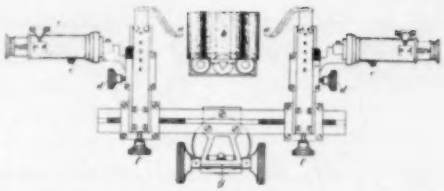

Fig. 7 (Drews). Birch-Hirschfeld's illustration of the Satler and Hering instrument, from above.

Ambialet

In 1903 Ambialet,[10] following Landolt's lead of using both the lateral orbital rim and the superior orbital rim, described a most complicated system in which he used four bars which he adjusted to the four sides of the orbit (figs. 8 and 9). Actually he measured from the superior orbital rim only occasionally, and depended chiefly on the lateral orbital rims and the horizontal plane. He made his footplate arm for the lateral orbital rim adjustable in vertical, horizontal, and torsional directions with a Vernier for each of these three adjustments. With this adjustable footplate he was able to keep the transverse bar transverse (that is parallel to the apparent frontal plane). He states that "during anthropometric studies I was led to have built a machine to measure protrusion of the eyeball." Obviously he had been much impressed with the asymmetries of

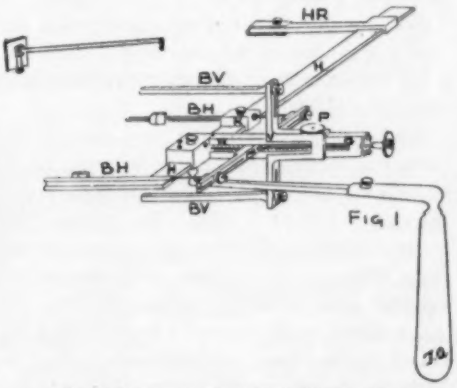

Fig. 8 (Drews). Ambialet's illustration of his instrument.

Fig. 9 (Drews). Ambialet's illustration of position of hand for measuring right and left eye.

the lateral orbital rims in skulls. He used Zehender's mirror device for obtaining fixation of the eye. One of the four arms is adjusted to the lateral, superior, medial, and inferior orbital rim so that the transverse bar remains parallel to the apparent frontal plane. The patient is asked if each bar makes equal pressure, and if so the vertical bars are locked. The prominence is then measured using the horizontal bar with the Zehender "regard" mirror placed on the bar resting on the medial orbital rim.

Ambialet states, "One knows that the relative protrusion cannot be deduced from the comparison of the two absolute extra-orbitary prominences, due to the asymmetries that can occur in the orbital rims. Nevertheless in certain cases I think that it is possible to deduce this measurement because the measurement of the axial orbital distances and the careful inspection of the skull and face give us a quite accurate notion of its symmetry. The search for the frontal plane cannot be avoided."

For measuring relative prominence he used a third horizontal arm, as in Figure 10. Used in this manner the instrument strongly resembles Hertel's.

Ambialet's article is the only one in the literature mentioning any verification on a model. He placed an artificial (model) eye in each orbit of a skull. He states "the measurements made with the instrument on these globes in the diverse given degrees of relative and absolute protrusion were always found to be correct when checked by direct consecutive measurements." Apparently he simply means the results were repeatable.

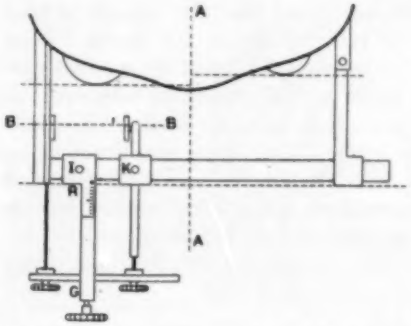

Fig. 10 (Drews). Ambialet's illustration; instrument adapted for measuring relative exophthalmos.

Jackson

In 1903 Jackson[11] presented his exophthalmometer (fig. 11). Both this paper and a later paper of 1921[12] seem to have been lost in the world's literature until Duke-Elder[13] mentions the 1921 paper. Birch-Hirschfeld[14] in *Graefe-Saemische Handbuch*, 1907, does not mention it in his excellent bibliography. Knudtson[15] tabled results of 14 different authors totalling around 2,500 patients measured, but omitted Jackson[12] who reported on 4,500 patients. Jackson's sighting device appears to be excellent. Certainly there seems to be no reason why reliable measurements could not be made with it. Jackson claimed "accuracy" of 0.5 mm.

Hertel

Hertel[16] described his renowned apparatus in 1905. He stated:

"Of all the exophthalmometers so far described the one described by Birch-Hirschfeld is the most

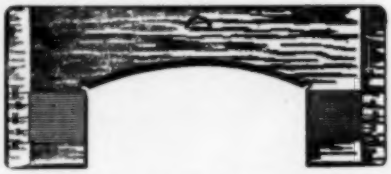

Fig. 11 (Drews). Jackson's illustration of his instrument.

accurate . . . but its handling is too complicated . . . and its price is high, 225 marks. . . . The apparatus is constructed so that the eye axes are parallel to the rulers.

"The corneal summits are reproduced on the mirrors, the mirrored images appear at equal distance behind the mirrors and therefore fall on the rulers as the apparatus is constructed so that the eye axes coincide with the rulers in g_1.

"For basic measurements in this construction the distance between the lateral orbital rim and eye (corneal) axis was measured in 221 adults, as about 20 mm. If, for instance, we supposed that the distance between the (eye) axis is smaller than 20 mm. then the image of the eye axis will not fall exactly on the ruler but slightly in front of it; then the image of the corneal summit will also fall in front of the ruler. In this case one cannot localize the image by simple reading of the ruler . . . *one has to sight the opposite eye so as to determine the corneal summit as related to the ruler* (italics are mine). This is extremely simple and requires no special procedures as the very small distance of the images to the rulers exclude any considerable parallactic deviations.

"Only with correct adjustment will the image of the iris (cornea) be perpendicular to the ruler. Deviations in the placement of the apparatus are promptly detected by the observer on the slide (base) rod as evidenced by incorrect inclinations . . . if the correct position, horizontal and parallel to the frontal plane, cannot be obtained by placement of the foot plates one is dealing with asymmetry of the skull, which is immediately detected this way.

"To give measurements results would be in error as I have found that there are great variations in the absolute values as determined on previous measurements in numerous cases. However the relative measurements are entirely reliable. The instrument is manufactured by Carl Zeiss, Jena, for 60 marks."

Instruments since Hertel (1905)

The Rollet-Durand[17] instrument (1912) is essentially a Hertel. Lohmann[18] (1913) described an instrument mounted on a headband to measure from the lateral orbital rim directly. P. Knapp[19] (1922), for comparative exophthalmos only, measured from the apex of the cornea to a plane lens in a trial frame. Arnold[20] (1928) also used the base of the nose as punctum fixum.

Schoenberg[1] (1935) presented a new instrument before this society. It is a simplified Hertel which uses no mirrors for the rulers:

"Determination of the tangent to the corneal apex is made with the aid of the visor device (which is mounted on the transverse bar)—the observer's eye, the two sharp edges of the visor, and the apex of the cornea seen in the mirror are (brought into) line."

This apparatus is most interesting, but with it Schoenberg claimed only an accuracy of 0.5 mm. Luedde[21] (1938) will be described later (see "Technique"). Murphey[22] (1943) used a simple divider fitted with a footplate—he could sight the cornea thereby measuring exophthalmos, or he could touch the cornea thereby obtaining some sort of measurement for comparative purposes.

In 1943 Lobeck[23] and in 1948 Ollers[24] reported stereomicromatic measurements on stereophotographs. Such measurements combined with Sattler-Hering measurements may give the absolute for which we have searched, so that clinical apparatus can be evaluated on actual patients. These articles have scarcely been mentioned since.

Galli-Mainini[25] (1946) uses two Luedde instruments mounted on a transverse bar. Gormaz[26] (1946) also measured from a transverse bar supported by two footplates (like Hertel), but used a cupped rod which was placed on the cornea. No sighting device is necessary but obviously any deviation of the eye will render this instrument useless.

Comment on historical background

The historical background is of considerable interest. For one thing Cohn coined the term, used a ruler, put a telescope on the ruler, made such extensive additions that the apparatus became unreliable, then ruined all of his work by switching from lateral orbital rim to superior orbital rim for no good reason. He defined normal within a 22 mm. range. Actually he left little for anyone else to do except correct his errors. Each one of the complicated apparatuses presented doubtlessly needed the loving patience of the inventor,

and in his hands gave good results.

Simple but ingenious ideas have been used, such as Zehender's and Emmert's, only to have these ideas refined and elaborated to such a point that the apparatus became unwieldy, such as the apparatus Birch-Hirschfeld and Ambialet presented. Along the way many authors—notably Ambialet, Emmert, Jackson, and Hertel—hinted at the problem caused by asymmetry of the skull but only Keyser seems to have gone into this problem. No one reported construction of a model to compare the accuracy of apparatus. The Hertel is such a beautiful instrument, at once complicated and wieldy, that it silences objections. Thus in ophthalmology we have had repeated the old story that has occurred in other fields: apparatus is made so beautiful that its shortcomings are overlooked.

Punctum fixum

Most apparatuses for measuring exophthalmos use the lateral orbital rim for the fixed point of reference. Cohn (1867), and Landolt (1874) used the superior orbital rim. P. Knapp (1922) and Arnold (1928) used the bridge of the nose. Lobeck (1943) and Ollers (1948) described stereomicromatic measurement of stereophotographs in which any point in the frontal plane of the face could be chosen.

Aside from these observers the lateral orbital rim, and some method of sighting or measuring the corneal apex, has been used by all the rest: Cohn (1865), Hasner (1866), Emmert, Zehender, and Keyser (all in 1870), Coccius (1872), Snellen (1874), Weiss (1895), Birch-Hirschfeld (1900), Ambialet (1903), Jackson (1903), Hertel (1905), Rollet and Durand (1912), Lohmann (1913), Helmbold (1914), Trendelenberg (1920), Schoenberg (1935), Luedde (1938), Mutsch (1939), Murphey (1943), Galli-Mainini (1946), and Gormaz (1946).

Of these Weiss and Gormaz placed a cup against the anesthetized cornea; while Coccius, Snellen, and Mutsch placed a cup against the closed eyelid. All the rest viewed the cornea directly or with a mirror device. Landolt used two points of reference, lateral and superior orbital rim, while Ambialet used the four sides of the orbit but measured only from the lateral orbital rim, and occasionally the superior orbital rim.

Kestenbaum (1946) suggested measurements from both lateral orbital rim and superior-inferior orbital rim plane.

A model for testing exophthalmometers

The one thing that has been lacking so far is a model with which various apparatus and techniques can be compared. Only Ambialet[10] made any attempt at all to do this. Apparently everyone from Cohn on used an ordinary ruler and promptly rejected it because slight inclinations made considerable errors. A satisfactory model is ridiculously easy to construct, after it is thought out. In order to test the apparatus used a model was made up as shown in Figures 12 and 13. With my model we can find out all about the errors with an ordinary ruler and with the Hertel chiefly because when we finish we can determine the correct answer. Clinically the correct answer is always lacking; therefore one never knows which clinical measurement he can depend on, and therefore cannot compare apparatus accurately.

Construction of the model

Sixteen-mm. Lucite balls which are sold for enucleation implants were chosen because most corneas have a radius of about eight mm. A hole about 15.5 mm. in diameter should be drilled with a drill press in a block of hard wood, the Lucite ball should be tightly wedged into it, and then the block of wood replaced in exactly the same position on the drill press. By this means one will certainly drill the Lucite ball through its very center. The Lucite ball should now be drilled about three quarters through. The ball is then easily tapped and

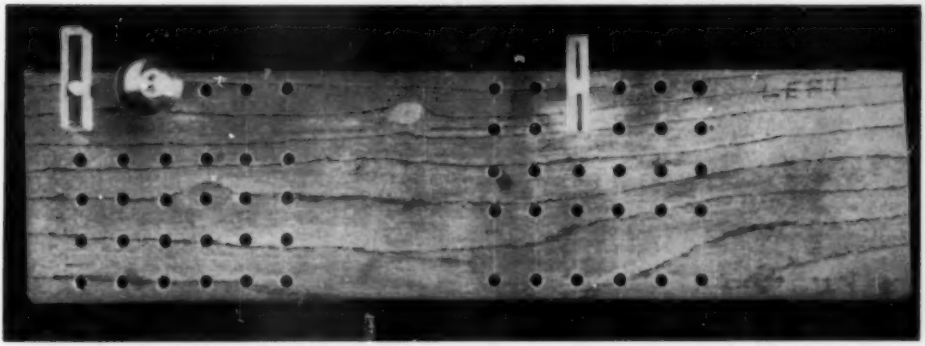

Fig. 12 (Drews). Exophthalmos model arranged for study of accuracy of instruments.

mounted on a screw. To be certain the tap does not go into the hole crooked, it should be fixed in the drill press chuck and rotated slowly by hand. Any scratches of the "equator" of the ball are of no importance—only its "corneal" surface need be perfect.

Small strips of plastic which can represent the lateral orbital rim are easily drilled, tapped, and mounted on screws as shown. I filed off the upper edge leaving a 1.0 to 2.0 mm. central strip unfiled. A block of hard wood was then drilled and tapped as shown in Figures 12 and 13. It is necessary that the back (undrilled) surface be as plane as possible, because all micrometer measurements are made from the back surface. A block of plastic was drilled and tapped only with great difficulty. The surface of plastic is as plane as a good mirror but the difficulty of tapping plastic is so great that hard wood seems much better for our purposes.

Holes are drilled 10 mm. apart as shown. For simulating vertical deviations of the eye more rows of holes are drilled 10, 20, 30, and 40 mm. below the first row. One can then simulate upward deviation of the eye by turning the block around. The wood holes soon become worn so that the "lateral orbital rims" easily turn when the Hertel or

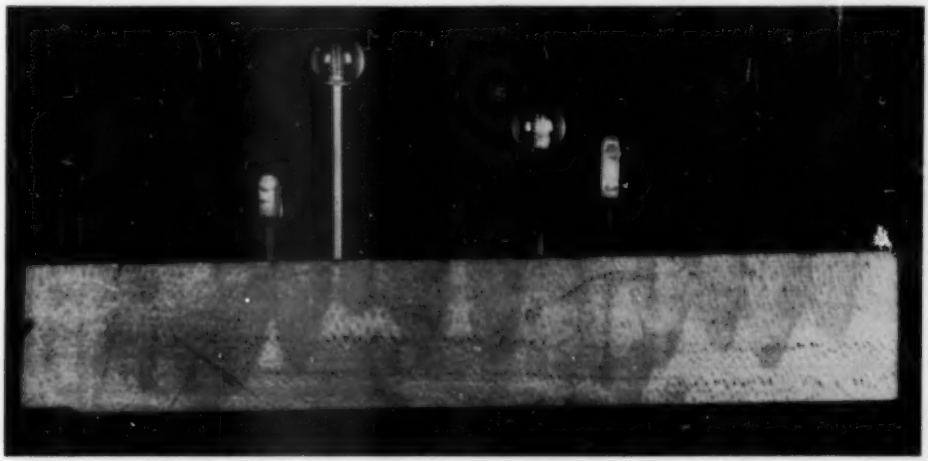

Fig. 13 (Drews). Exophthalmos model made very asymmetrical (but with no vertical or horizontal asymmetry).

ruler is used. Therefore another set of holes is drilled on the other edge of the block. This is easily done with one setting of the drill press. But the back side of the block is left undrilled and smooth. One can make several blocks almost as easily as one.

Several holes are drilled in the center so that a "nose" can be placed there; without the "nose" one sees two plastic balls with the Hertel and may get confused.

With this very simple apparatus we can now test our measuring devices. Of course the "lateral orbital rims" are very nearly parallel to the frontal plane of the "face" and are straight edged. In addition they are not covered by skin and fat of somewhat variable (between individuals) thickness. If the patient's lateral orbital rims were as ideal as our model's, clinical measurements would of course be easier. But for a comparison of the apparatus used this simple model serves very well. One must remember that clinical exophthalmometry never can be this accurate.

After measurements are made and repeated as often as desired, then a Boley gauge, hereafter simply called micrometer (fig. 14), is used to measure the distance of the lateral orbital rims and the corneas to the back surface of the wood. By simple subtraction the exact exophthalmos for each "eye" is obtained. With this model we can simulate nearly all the asymmetries possible except that our lateral orbital rim is always smooth and parallel to the frontal plane. We could of course make "lateral orbital rims" of various shapes and inclinations and covered with various thicknesses of rubber or felt but such realism would serve no useful purpose.

Measurements with the model

The chief trouble in measuring with a ruler is that (1) the ruler must be held parallel to the visual line and perpendicular to the frontal plane, and (2) one must sight at right angles across the ruler. The patient should be in position of "eyes front" with all instruments. In order to exaggerate any error made in sighting the cornea across a simple ruler the model was set up with only one "eye" so that the right lateral orbital rim was 100 mm. from the cornea and the left was 20 mm. from the cornea. Ordinarily the optical axis of the cornea will be slightly more than 16 to 17 mm. from the vertical axis through the lateral orbital rim. Duke-Elder[13] gives 4.5 mm. between sclera

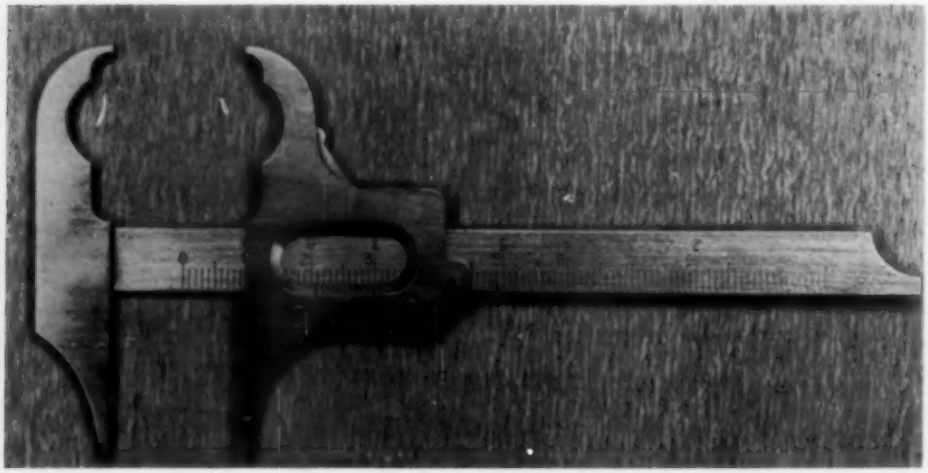

Fig. 14 (Drews). Boley gauge (micrometer).

TABLE 1

MEASUREMENTS ON EXOPHTHALMOMETER MODEL ARRANGED AS IN FIGURE 12

Distance from lateral orbital rim to apex of cornea	I		II		III	
	a	b	c	d	e	f
	100	20	100	20	100	20
1. Micrometer	9.5	9.8	20.4	20	29.8	30.2
2. Ruler, 30 cm.	9.5–10	9.5	20 –21	20.1	29.5–31	30.5
3. Luedde	9.5–10.5	9.5	19.5–21	19.5	28 –31	30
4. Hertel Krahn	9.3	9.5	18.5	19.4	27.4	29.7
5. Hertel dextroinverted	10.5	11.1	19.6	21.5	28.1	31
6. Hertel "head" inverted	9.6	9.8	—	—	28.3	29.8
7. Hertel Zeiss	11 –12	8.5	19 –20	18.5	27 –28	30
8. Hertel dextroinverted	12 –13	9	19 –20	19	28 –29	29.5
9. Hertel "head" inverted	11 –12	8.5	19 –20	19	27 –28	29.5

and lateral orbital wall, which added to the 12 mm. plus or minus radius of the globe in horizontal plane equals 16.5. In actual measurements on 221 patients, Hertel found 20 mm. about right.

Measurements were then made with the Hertel (Krahn), Hertel (Zeiss), the micrometer, a simple ruler 30 cm. long, and the Luedde ruler. The results are as shown in Table 1. Table 1 also shows the results of measuring with three separate settings of the "cornea." The "lateral orbital rim" was changed very slightly once, in column a, otherwise the "lateral orbital rims" are the same throughout as indicated by the micrometer measurements.

Table 2 is calculated from Table 1 to show how high or how low the readings were in comparison to the micrometer measurements. For comparing the accuracy of the instrument, columns a, c and e, and b, d and f, should be compared. At 20 mm. distance the Krahn is quite reliable in all three parts of its scale. The Zeiss reads high except in the higher parts of its scale. At 100 mm. Krahn is far more reliable than Zeiss. Either the ruler or Luedde is more reliable than Krahn or Zeiss. The measurements in Table 1 were made at widely varying times and in various orders so as to avoid prejudice as far as possible. The micrometer measurements were made last.

From measurements on the model, I believe that none of these instruments ever can be accurate closer than 0.5 mm. on any *one* measurement even on the model. The measurements in columns a, c, and e show that the ruler and Luedde should be more ac-

TABLE 2

THE ERROR IN MEASUREMENT IN TABLE 1 WHEN COMPARED IN MICROMETER MEASUREMENTS AS STANDARD

Distance from lateral orbital rim to apex of cornea	I		II		III	
	a	b	c	d	e	f
	100	20	100	20	100	20
1. Micrometer	0	0	0	0	0	0
2. Ruler, 30 cm.	0 to +0.5	−0.3	−0.4 to +0.6	+0.1	−0.3 to +1.2	+0.3
3. Luedde	0 to +1.0	−0.3	−0.9 to +0.6	−0.5	−1.8 to +1.2	+0.3
4. Hertel Krahn	−0.2	−0.3	−1.9	−0.6	−2.4	−0.5
5. Hertel dextroinverted	+1.0	+1.3	−0.8	+1.5	−1.7	+0.8
6. Hertel head inverted	+0.1	0	—	—	−1.5	+0.4
7. Hertel Zeiss	+1.5 to +2.5	−1.3	−1.4 to −0.4	−1.5	−2.8 to −1.8	−0.2
8. Hertel dextroinverted	+2.5 to +3.5	−0.8	−1.4 to +0.4	−1.0	−1.8 to +0.2	−0.7
9. Hertel head inverted	+1.5 to +2.5	−1.3	−0.6 to −0.4	−1.0	−2.8 to −1.8	−0.7

curate than Krahn or Zeiss clinically. In the past the only reason why an ordinary ruler was not used to measure the vertical distance from the lateral orbital rim to apex of cornea was that inclinations of the ruler and improper sightings produced considerable errors.

Columns a, c, and e prove that the ruler or Luedde can be held satisfactorily. The error between a, c, and e, and b, d and f, should be in proportion of 100:20 for rulers if the measurements were perfect. For the Krahn or Zeiss there should be no difference if the mirrors are set at 45 degrees, contrary to Hertel. However, the Krahn shows roughly (table 2) an error of between two and five to one. Because of this an attempt was made to check the instrument by dextroinverting the instrument and also by inverting the "head."

The measurements made by dextroinverting the instrument seem not reliable and for no discernible reason (5 and 8). Those made by inverting the "head" (6 and 9) are fairly good.

This method of checking the instrument is similar to the way in which we check a Maddox rod. We cannot check the instrument clinically by dextroinverting it because both the Krahn and Hertel footplates are mounted about eight mm. below the center of the instrument. If the instrument is turned around the footplates will rest on the lateral orbital rim about eight mm. above the horizontal plane of the eye and in this position the lateral orbital rim curves strongly forward.

I believe the Hertel-Krahn has better footplates than the Zeiss. They are flat instead of curved and are set only two mm. instead of five mm. from the midline of the footplate arm. Therefore they are not so uncomfortable. On the model it is obvious how difficult it would be on a patient to place the lateral orbital rim in the center of the concave Hertel (Zeiss) footplate.

The model was rearranged with a P.D. of 60 and interorbital distance of 100, but with the right lateral rim of the orbit forward to 48 mm., the right cornea forward to 60 mm., the left lateral rim of the orbit forward to 32 mm., and the left cornea forward to 64 mm. as shown in Figure 13. Measurements were obtained as shown in Table 3. Note that with this extreme asymmetry the Hertel measures the right four mm. too far forward, and the left four mm. too far backward.

TABLE 3

MEASUREMENTS FROM FIGURE 13, VERY MARKED ASYMMETRY OF LATERAL ORBITAL RIM WITH MARKED RELATIVE EXOPHTHALMOS

Very Marked Asymmetry		
Right lat. rim orbit forward	48	
Right cornea forward	60	
Left lat. rim orbit forward	32	
Left cornea forward	74	
	Right	Left
Hertel-Krahn	16	28
Ruler	12	31.5
Micrometer	12	32

My son, Dr. Robert C. Drews, calculated what the error should be when there is tilting of the Hertel in the horizontal plane, *provided the corneas are equally forward.* The results of this calculation are as shown in the diagram and formula, Figure 15. However clinically we can never be exact about the distance S, or O. If both the ruler and the Hertel measurements are made, the value of O and S can be calculated from this formula, and the two answers should be the same calculated from the answers on the two eyes. Making a ruler measurement, however, for the distance D involves the fallacy of supposing that the ruler is actually perpendicular to the frontal plane. Without further evidence one may suppose that calculations of S from such measurements would merely quantitate the oculist's guess at the asymmetry of the face, and his ability to hold the ruler perpendicular to the nonexistent frontal plane. Of course clinically we have no way to be sure the corneas are on the same level.

When there is no considerable asymmetry the Hertel is quite accurate, at least to 0.5 to 1.0 mm. Even when there is marked

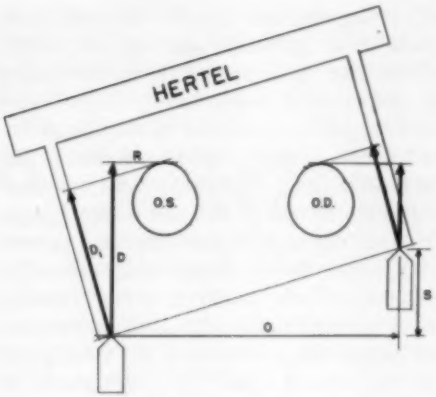

Fig. 15 (Drews). Diagram showing "the Hertel error."

asymmetry the comparative measurements are fairly good. Measurements with the Hertel are of some absolute and relative value only if there is no great asymmetry. Thus in Figure 15 assuming the right lateral orbital rim is three mm. farther forward (S = 3), interorbital distance, O = 100, and D for O.S. = 12, with D for O.D. = 9, then according to our formula the Hertel should read 11.38 for O.S.* instead of 12 (0.62 mm. too little) and 9.37 for O.D.† (0.37 mm. too large). This will give a relative difference of 11.38 to 9.37 = 2.01 mm.

On the other hand the ruler ideally will give a relative difference of three mm. which by our definition is correct even though the two corneas are level. Since we cannot be sure the lateral rims are ever symmetrical and since only three-mm. asymmetry in position of the lateral orbital rims will produce nearly one mm. difference in the measurements of the two eyes it follows that, just as Hertel said, the absolute and relative values cannot be determined accurately in any one case using the Hertel.

All the instruments which measure each eye with a fixed transverse bar will have the Hertel error. These include Jackson, Hertel, Schoenberg, Galli-Mainini, and Gormaz. Undoubtedly Hertel knew all about this error when he warned that the transverse bar must be parallel to the frontal plane of the face, and that the instrument is of no value for relative measurements.

Vertical asymmetry of 10 to 20 mm. also was measured with the model. The Hertel instrument is much worse in such asymmetry especially if there is also horizontal asymmetry.

Technique

I. Hertel

Hertel's original article extensively quoted in translation does not give adequate details about the exact technique. It is necessary that the eye being measured look straight ahead as in "eyes front." Hertel advised that the ruler and corneal images be sighted with both eyes. In addition he advises sighting the opposite eye if the ruler and cornea do not appear in focus, but this second part of his instructions really seems unintelligible (or more likely not translatable) and has simply been omitted by following authors. With the model there appears to be no greater trouble in sighting the Krahn instrument when the distance from the lateral orbital rim to corneal apex is 100 than when it is 20. One would think from Hertel's paper that sighting at 100 would be very uncertain. Apparently stereoparallax is not very important. Actually the Hertel-Zeiss measurements on the model were found more exact when the instrument was sighted with both eyes as Hertel advised. Therefore stereoparallax is of some importance.

Some authors advise having the patient fix the root of the examiner's nose. If the examiner really sights with both eyes as

* $D_1 = \frac{DO - RS}{\sqrt{O^2 + S^2}} = \frac{(12)\ (100) - (16)\ (3)}{\sqrt{100^2 + 16^2}} = 11.38$

† $D_1 = \frac{DO + RS}{\sqrt{O^2 + S^2}} = \frac{(9)\ (100) + (16)\ (3)}{\sqrt{100^2 + 16^2}} = 9.37$

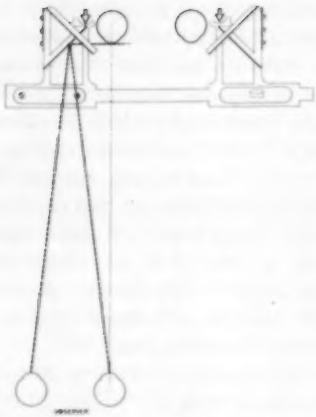

Fig. 16 (Drews). Hertel's method of sighting his instrument.

Hertel advised he will have the bridge of his nose opposite the reading on the Hertel scale, as shown in Figure 16. This figure is drawn according to scale assuming the patient and examiner both have P.D. 65, the patient has exophthalmos 15 mm., and distance from lateral orbital rim to apex of cornea is 20 mm. The distance from apex cornea to Hertel mirror will be 32 mm. It is obvious that *if one sights with both eyes the patient should fix the examiner's right eye with his right eye, and if one sights with the left eye the patient should fix the bridge of the examiner's nose.*

The Hertel-Krahn has a most convenient sighting device. With the model as used in Figure 12 one sees the sighting marks of both prism devices so that four marks are visible. It is difficult to get them in perfect line, therefore there must be some small error in the instrument. On patients the nose usually will prevent this double sighting. The Hertel-Krahn sighting device is most accurate with the model when one lines up the two red marks sighting with one eye only and then without shifting one's head or the instrument takes the reading.

II. The simple ruler

A five-mm.. corner on each end of a 30-cm. ruler should be polished off. Then the point of contact with the ruler is easily held in the lower most posterior part of the lateral orbital rim. It is not nearly as distressing to the patient as is the Hertel. It is essential to hold the ruler parallel to the visual line and perpendicular to the lateral orbital rim. In order to be sure about this one can place a disc on the end of the ruler with a 10 mm. aperture centered 20 mm. from the perpendicular through the lateral orbital rim. One could also mount a mirror, as did Zehender, for a sighting device. An assistant can face the patient and easily see if the ruler parallels the line of sight. The ruler should be inclined about 45 degrees. When it is, the ruler markings appear to meet the ruler edge at 90 degrees only where one is sighting at 90 degrees to the ruler; elsewhere the markings are slightly askew. This is difficult to judge but a little practice will greatly sharpen one's skill. I have used this method of alignment exclusively since 1936 with satisfaction.

A four-cm. ruler was also tried on the model. Its measurements were not nearly as accurate as those of the 30-cm. ruler. Therefore one cannot expect to be able to hold a short ruler (for instance, Luedde) properly. Even with a telescopic sighting device or a Zehender "regard" mirror the ruler must be held perpendicular to the frontal plane and parallel to the visual line. In order to do this the ruler should be 30 to 45 cm. long.

III. Luedde

The Luedde exophthalmometer should be placed in the same way as the ordinary ruler. A sighting at right angles is assured if one sees the cm. score marks on each side of the ruler in line near the apex of the cornea and out of line the proper amount on either side of the cornea. If it is held perpendicular to frontal plane and parallel to visual line, and if it is sighted properly, it will give very good readings. However the instrument is too short to be held properly. The Luedde ruler would be a much better instrument if instead of being 1.0 by 1.0 by 8.0 cm. it

were made 1.0 by 2.0 by 30 cm., and had long score marks on both sides of the narrow edges to mark each five mm.; also it would be better if one did not have to see the cornea through the ruler. It could be fitted with footplates similar to those on Hertel-Krahn. Such a ruler could give better readings. Both of the Hertel instruments, and the Luedde, are made difficult to read because the scale numbers interfere. They should be better placed or perhaps omitted altogether. They are particularly annoying if one spends several hours at a time measuring my model.

IV. My new exophthalmometer

Figure 17 shows a new instrument designed to fulfill the three basic requirements for good exophthalmometry:

1. It can be sighted accurately at right angles because its 50 mm. width provides excellent parallax.

2. It can easily be held parallel to the visual line by virtue of a very simple second sighting device as indicated in Figure 17.

3. It can be held more nearly perpendicular to the apparent frontal plane because its length of 30 cm. makes any deviation more evident.

It is recommended that either the patient's second eye be covered and the patient look past the sight, at some distant object directly in front of him, or at the sight itself; or else that the patient look at the sight with both eyes. The patient must not sight some distant object past the sighting device with both eyes open, lest one measure the non-sighting eye. On the model, as in Figure 12, it gave answers far more accurate than the simple ruler and with much greater certainty and ease.

The center of the cornea should be sighted on the horizontal line of the block as shown. The horizontal line on the opposite side helps one to hold the block squarely. If one wishes the 20-mm. line could be colored red and the 30 mm. blue, or the numbers can be engraved on the top surface of the block

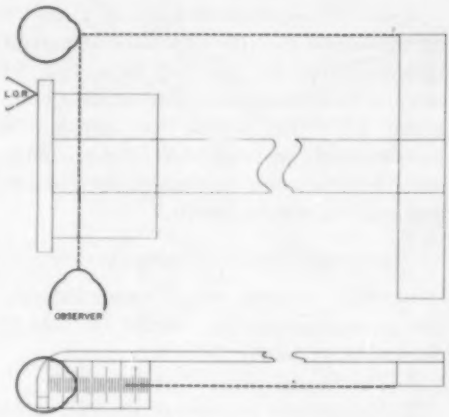

Fig. 17 (Drews). Drews' new exophthalmometer.

where they will not confuse the reading. With this instrument single measurements should consistently be accurate to 0.5 mm.

Clinically, it is easy to use and seems satisfactory. While I know the simple ruler can give satisfactory results in my hands, I am sure the new instrument can be recommended for general use. Storz Instrument Company of St. Louis will make this new instrument.

All apparatus which measures from the lateral orbital rim has an unavoidable error: the greater the pressure over the lateral orbital rim and the longer this pressure is maintained the more the soft tissues over the lateral orbital rim are compressed. An error of 0.5 to 1.0 mm. can easily be produced by long pressure. It is not practical to broaden the footplate in order to reduce this error. One could have the footplate connected to a spring balance and thereby make a measured amount of pressure for a certain time but such a refinement is unnecessary if one only remembers to make about the same pressure and try to take about the same amount of time with each measurement. Because of this unavoidable error Birch-Hirschfeld reported his measurements in half mm. His apparatus (Sattler-Hering) could measure very accurately, doubtlessly to 0.01 mm., were it not for this error.

Again, all apparatus measuring from the lateral orbital rim has an unavoidable error resulting from the fact that we cannot determine the frontal plane. This error is minimized with the Hertel for comparative measurements, and can be reduced to a minimum with this new instrument for absolute and relative measurements.

Anthropologic considerations

In order to make perfect exophthalmometer measurements we should be able to determine accurately

1. The frontal plane of the skull
2. The relative position of the two orbits in the skull
3. The relative positions of the two lateral orbital rims
4. The measurements of each orbit (length, width, height, capacity, and so forth)
5. An axis through the lateral orbital rim vertical to the frontal plane (which axis is, after all, a function of the frontal plane). Such an axis would be parallel to the visual line with "eyes front."

Since none of these measurements can be determined accurately, exophthalmometry will always remain inexact. All efforts to measure exophthalmos have had to make some compromise with the five unknowns listed above.

In the following pages I relate my efforts at measuring the relative positions of the two lateral orbital rims.

In the examination of 100 white male skulls of the Terry Collection, Washington University School of Medicine, which Prof. Mildred Trotter kindly allowed me to use, I was readily convinced that we could not determine the frontal plane. Probably "eyes front" as defined in textbooks on external ocular muscles is the best I can do. In looking at the skulls in general, especially if the base of the skull is held toward the observer at arm's length with a thumb nail hooked over each lateral orbital rim, the left lateral orbital rim seems to me to be definitely forward in about three quarters of the skulls. It was because of this impression that a serious effort to measure the position of the lateral orbital rims was made. However, in the measuring device this impression was not verified. Unfortunately I cannot say that this proves my first impression was wrong, because there are so many factors which influence the guess as to when the skull is "straight" in the device.

An attempt was made to measure the relative prominence of the two lateral orbital rims. A crude measuring device was built so that a skull with the skull cap removed could be placed securely. Its front and back walls were very carefully constructed so that they were parallel within 0.5 mm. or less (fig. 18).

The skull was placed as symmetrically as possible. For this purpose chief reliance was placed on the intermaxillary suture, the foramen magnum, and the two glenoid fossas. I do not think one can really say just how such a skull should be placed. The asymmetry of the skull is very impressive when such an attempt is made to place it symmetrically. I also tried to have the frontal plane of the "face" squarely placed. A screw tightened against the frontal bone holds the skull satisfactorily.

Then the distance from each lateral orbital rim to the front surface of the device was measured with the micrometer (fig. 14). I also measured the distance from the posterior

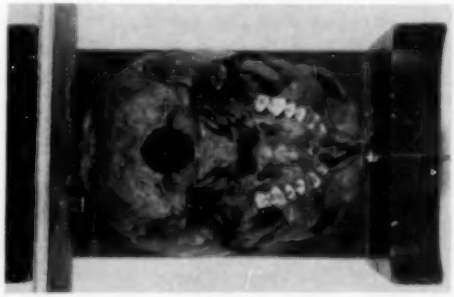

Fig. 18 (Drews). Simple device for fixing a skull so that prominence of lateral orbital rim may be measured.

TABLE 4

COMPARING THE TWO MEASUREMENTS MADE ON EACH OF 50 SKULLS

Same measurement	20
0.5 to 1.0 mm. difference	22
1.5 to 2.0 mm. difference	7
2.5 mm. difference	1
	50

wall of each auditory canal to the back surface of the device. Fifty white male adult skulls were each measured a number of times and the best measurements within 0.5 mm. were averaged. The skull was then removed and set aside: after four other skulls were measured the original skull was then placed back in the measuring device and remeasured. No reference was made to the first series of measurements. Only after 10 skulls were measured both times were the answers compared. In this way an attempt was made to obtain unbiased measurements.

The results are as shown in Tables 4, 5, 6, and 7. In eight of the 50 skulls the two measurements were at variance by 1.5 mm. or more. These skull measurements are shown in detail in Table 6. These same measurements are simplified in Table 7, omitting the measurements from the posterior wall of the auditory canal. Analysis of Table 6 shows no definite evidence of rotation of the skull in between the two measurements. However, the measurements concerning the symmetry of the auditory canals are only about half as accurate as those concerning the lateral orbital rims. This may be largely because the auditory canal slopes forward making it very hard to decide just where to

TABLE 5

AVERAGE AMOUNT OF ASYMMETRY IN THE RELATIVE POSITION OF THE LATERAL ORBITAL RIMS

On 50 white male skulls—100 measurements
Right, lateral rim, farther forward
39 times for a total of 95.5 mm., or an average of 2.436–.
There was no asymmetry in 22 measurements
Left, lateral rim, farther forward
39 times for a total of 54.0 mm., or an average of 1.386–.

TABLE 6

THE ACTUAL MEASUREMENTS, CORRESPONDING TO A, B, X, AND Y IN FIGURE 19, SHOWING ASYMMETRY IN PROMINENCE OF THE TWO LATERAL ORBITAL RIMS OF MORE THAN 1.5 MM. IN EIGHT SKULLS

Skull	Right, A	Left, B	Right, X	Left, Y
8	21	25	58	53
	21	27	61	52
9	21	21	61	59
	19.5	22	63	59
12	12	14.5	68	62
	11	15	68	62
18	11	10.5	63	63
	9.5	11	64	63
21	42	40	58	61
	40	40	61	62
23	43	44	62	58
	42	45	63	60
31	27	28	76	75
	28	27	76	76
42	13	15–	63	61
	11	15	66	59

place the micrometer. Figure 19 shows very readily what would be the effect of rotating the skull in the measuring device. Figure 19a shows a schematic skull squarely placed. Figure 19b shows the same skull with its center(X) in exactly the same position but with the skull rotated. The distance A, B, X, and Y in Figure 19b will all vary in a definite manner from those in Figure 19a.

In Figure 19b note that as A increases, B and X decrease and Y increases, or, as A de-

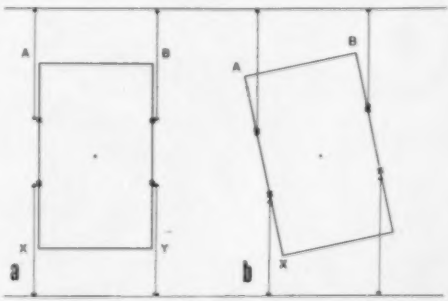

Fig. 19 (Drews). Schematic skull in schematic measuring device (A and B).

TABLE 7

TAKEN FROM TABLE 6. THE AMOUNT OF RELATIVE PROMINENCE OF RIGHT OR LEFT LATERAL ORBITAL RIMS IN THE TWO MEASUREMENTS

Difference 1.5 mm. or more				
Skull	Right		Zero	Left
8	4	6		
9	2.5		0	
12	2.5	4		
18	1.5		N.B.	0.5
21			0	2
23	1	3		
31	1		N.B.	1
42	2	4		

N.B. (only #18 and #31 of all 50 skulls was there such an error).

creases, B and X increase and Y decreases.

In Tables 6 and 7:

Skull 8 may show some evidence of rotation but note that A remains 21 in both measurements; if there was rotation one of the A measurements must have been wrong.

In Skull 9 note that Y remains 58 in both measurements.

Skull 12 showed both X and Y unchanged.

Skull 18 shows almost no change in X and Y although A and B change 2.5 and 0.5 mm., respectively.

Skull 21 shows B unchanged (similar to Skull 8).

Skull 23 shows the measurement changing in a way consistent with rotation of the skull except that Y increases instead of decreasing.

Only Skull 42 may answer the criteria and then only if the first B should have been around 13 instead of 15—.

Analysis of the other 42 skulls showed the measurements, made to determine how far forward the bony auricular canals are located, did not really help in determining whether or not the skull had been rotated between the two measurements.

The distance between the two lateral orbital rims is measured easily to one to two mm. on skulls. Results were as shown in Table 8. These are roughly comparable to figures on Hertel measurements from Knudtson.[15]

TABLE 8

THE DISTANCE BETWEEN THE LATERAL ORBITAL RIMS MEASURED ON 100 WHITE MALE SKULLS IN THE TERRY COLLECTION

On 100 white male skulls—the distance between the 2 lateral rims of orbits was	
88– 89 mm.	8
90–100 mm.	85
101–103 mm.	7
	100

RELATIVE EXOPHTHALMOMETRY

Knudtson's[15] carefully analyzed series of measurements on 362 normal eyes show the right eye more prominent in 130, left eye in 73, and no difference in the remaining 159, or 44 percent. Such a preponderance of relative exophthalmos for the right eye could easily be explained if there is a tendency for the right lateral orbital rim to be farther forward than the left. Knudtson quoted Wagener[2] as stating that in his series of 200 normal eyes, the right eye was more prominent in 139, left eye in 11, and there was no difference in the remaining 50. However, Knudtson reversed Wagener's figures; Wagener actually reported the left eye more prominent in 139, right eye in 11.

Table 5 indicates that as far as the lateral orbital rim alone is concerned, that is, when conditions are as in Figure 15, Hertel measurements should be equal for the two eyes in 20 percent, the right eye should average nearly one mm. farther forward in 40 percent, and the left eye should average nearly 0.6 mm. farther forward in the remaining 40 percent.

Simple inspection of the skull which to me showed the left lateral orbital rim farther forward in about three fourths of the skulls would indicate that left exophthalmos should be greater than right in three fourths of the cases. Unfortunately, even very careful measurements fail to be conclusive so that I cannot say that my rough impression is incorrect and that the measurements are actually reliable. Certainly 50 skulls are not enough to be reliable for any accurate analysis but they may show a trend fairly well.

Of the 1,500 skulls in the Terry Collection there were only 80 usable white male skulls with skull cap removed and not sectioned anterior-posteriorly, so this series cannot be greatly enlarged. A series of Negro skulls could be very large but would mean little.

Knudtson's tables show a marked tendency to measure exophthalmos in round mm. which tendency I believe correct. It is also possible that some oculists have a similar tendency to record both measurements the same. Thus, if one measured a patient and found exophthalmos: right eye, 19.0, and left eye, 18.5, he might very justly be persuaded that 19 and 19 would be about right and record it as such.

Table 9 is compiled after the format of Knudtson.[18] Four more authors (Cohn[2-4], Jackson,[11] Ruedemann,[29] and Drescher and Benedict[29]) have been added to his table and the figures simplified as far as possible. A dash indicates insufficient information given.

Birnbaum, Helmbold, Jackson, Soley, and Knudtson reported their statistics for both males and females. I have combined all these because there is no "significant" difference (Duke-Elder[13]). Jackson analyzed his in age groups of each five years.

Table 9 shows very marked differences in the percent of patients who show no relative exophthalmos (last column) and a very marked difference in which eye is more often more prominent (second last column). The whole subject of relative exophthalmos seems hopelessly confused. How could

TABLE 9

A REVIEW OF EXOPHTHALMOMETER MEASUREMENTS ON NORMAL PATIENTS

Author	Instruments Used	No. of Patients Examined	Absolute Exophthalmos		Relative Exophthalmos			
			Range mm.	Average or Mean mm.	Mm. of Relative Exophthalmos	More Prominent O.D. (%)	O.S.	% of Cases Showing Relative Exophthalmos
Cohn, 1865	own	300?	10–18	—	—	—		—
Cohn, 1867 see (1)	own	427	−10 +12	—	0.5–8.0	—		82
Emmert, 1870	own	200	9–20	12–14	0–3	—		93.5
Keyser, 1870	own	500?	9–18	—	0–2	—		rare
Birch-Hirschfeld, 1900	see (2)	24	11.5–18	14	0–1.0	17	25	42
Geraud, 1912	see (3)	41	10–16	13	—	—		—
Birnbaum, 1915	Hertel	150	11–19	15	—	—		—
Schlabs, 1915	Hertel	50	10–21	—	0.2–1.5	90	0	90
Woods, C. A., 1915	Hertel	200	—	12–14	—	—		—
Helmbold, 1916	Hertel	525	9.5–24.5	16+	—	—		—
Jackson, 1921	own	4500	10–23	16–17	—	6.7	14.3	21
Lee, 1930 see (4)	Hertel	400	8–21	14.6	—	—		—
Ruedemann, 1936	Hertel	1000	14–20	18.8	—	see (5)		—
Wagener, 1934	Hertel	200	11–24	17.9	0.5–2.0	5	70	75
Galli-Mainini, 1942	see (6)	50	14–17.5	—	—	—		—
Soley, 1942	Hertel	65	15–20	15.9	—	—		—
Gormaz, 1946	own	—	12+	14–16	—	—		—
Knudtzon, 1949	Hertel	362	11–24	17+	0.5–2	36	20	56
Drescher-Benedict, 1950	Hertel	100	10–24	17.3	0.5–2.0	—		—

(1) Cohn 1867 measured from superior orbital rim.
(2) Satler and Hering instrument.
(3) Rollet and Durand instrument.
(4) All of Lee's patients were Chinese.
(5) Average exoph. for all right eyes 18.9.
Average exoph. for all left eyes 18.7.
(6) A modified Luedde instrument.

Knudtson find the right eye more prominent twice as often as the left, while Wagener found the left 14 times as often as right? It may very well be that Hertel was right absolutely and not relatively when he said his instrument is of no value in measuring absolute or relative exophthalmos. At any rate these results are a mystery, as Wagener said. The Hertel error tends to reduce the relative exophthalmos measured.

Exophthalmos varies slightly under many conditions. Jackson[31] (1921) reported "a general tendency of the eye to protrude on being widely opened which is easily observed with corneal microscope. In 200 cases this protrusion amounted to nothing in seven, up to 0.25 mm. in 40, 0.25 to 0.50 mm. in 123, 0.50 to 0.75 mm. in 21, and 0.75 to 1.0 mm. in five." Unfortunately he gave no data to prove that the whole head did not come forward when the eyebrows were raised in wide open stare.

Birch-Hirschfeld[14] (1907) showed varying exophthalmos measurements in varying positions of the head, after compression of facial and jugular vein, and after cocaine.

Snellen[27] reported extensive investigation on this physiologic problem. Birch-Hirschfeld's[9] very accurate measurements failed to show any evidence that exophthalmos varies more than 0.5 mm. under normal conditions.

Exophthalmometry in textbooks

Our textbooks dismiss exophthalmometry with brevity. Perera-May[30] says "exophthalmos can be determined roughly by placing a transparent ruler at the lateral orbital rim and observing the height of the cornea. A more precise measurement can be obtained with the exophthalmometer." Gifford[21] states "the Hertel is convenient but not necessary." Adler[32] says "in every case it is best to measure exophthalmos even by the crude method of holding a millimeter scale against the lateral orbital rim," and gives a picture; he does not mention Hertel.

Goar[23] says simply "two types are commonly used in this country, the Hertel and Luedde." Parsons and Duke-Elder[34] say "the amount of exophthalmos can be obtained only with special mechanical devices (exophthalmometers)." They then describe the test by sighting over the brow. Berens[35] and also Sorsby[36] do not list the subject.

Berens and Zuckerman[37] give about a page of fairly full instructions for ruler, Luedde, and "exophthalmometer" which is a Hertel.

Reese[38] devotes six to eight lines, and also mentions Friedman's method using special contact lenses and X-ray. Ingalls[39] says "to obtain accurate measurements a reflecting instrument must be used."

Kestenbaum[41] uses five pages most of which are devoted to his own method of measuring from a vertical straight edge applied to superior and inferior orbital rims. Tassman[40] describes the Hertel and says nothing about how to use it.

Fuchs and Duane[42] and Fuchs and Brown[43] simply say to use the Hertel. De-Schweinitz[44] says "for measuring the degree of exophthalmos Edward Jackson has devised a simple scale or proptometer. A useful and accurate instrument for this purpose is the exophthalmometer of Hertel."

Duke-Elder[13] gives an excellent chapter of five pages, while Birch-Hirschfeld[14] covers the subject thoroughly in eight pages. Aside from Kestenbaum and Berens and Zuckerman, one has to read encyclopedic volumes such as Duke-Elder and Graefe-Saemische to find a usable technique described. Exophthalmometry is more important than this. Furthermore, technique is not obvious else there would not be so much variance in the technique where it is described.

Conclusions

1. A simple model is presented with which it is possible to compare and even calibrate exophthalmometers.

2. The basic Hertel error is described and discussed. A formula expressing this possible error when the two corneas are in the same horizontal plane is given.

3. Any exophthalmometer using the lateral orbital rim as punctum fixum must be used with the head and eyes in position of "eyes front," the rule must be parallel to the visual line and perpendicular to the frontal plane, and the sighting must be done at right angles to the rule. Compression of the soft tissues over the lateral orbital rim gives rise to an unavoidable error which will be variable if the amount and duration of pressure are variable.

4. An attempt to measure the relative position of the two lateral orbital rims in a series of skulls is described.

5. A new simple reliable exophthalmometer is described.

516 Metropolitan Building (3)

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THE SURGICAL TREATMENT OF EXOPHTHALMIC OPHTHALMOPLEGIA*

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Exophthalmic ophthalmoplegia[1] is a syndrome which occurs in approximately three to four percent of persons with primary toxic goiter. It has been described under a number of terms—malignant exophthalmos,[2] hyperophthalmopathic form of Graves' disease,[3] progressive exophthalmos,[4] severe infiltrative ophthalmopathy,[5] idiopathic myositis involving extraocular muscles,[6] paradoxical exophthalmos,[7] thyrotropic exophthalmos,[8] pituitary diencephalic exophthalmos,[9] and edematous exophthalmos of endocrine origin.[10]

The symptoms may begin before there is any evidence of thyroid dysfunction, may occur concomitantly with hyperthyroidism, and may sometimes become evident only after remission of the hyperthyroidism. Generally, both eyes are affected, although unequally.

The onset may be insidious or rapid but usually begins with a protrusion of the globe which continues to progress. This is accompanied by an edema and tightness of the lids, increased lacrimation, disturbance of convergence, congestion and chemosis of the conjunctiva, increased sensitivity to light, and a definite resistance to pressure on the globe when an attempt is made to displace it posteriorly.

The extraocular muscles may be involved individually or in groups which move the eye in one plane. Brain emphasized that the muscles of elevation were usually affected first.[11] When the orbital pressure is extreme and prolonged, all movements may be more or less uniformly restricted. A frequent late development is fixation of the eye in depression. The globes are so immobilized they cannot be moved passively by traction with forceps.[12]

If the condition continues to progress, these signs and symptoms increase in severity and may lead to optic atrophy with permanent visual loss or corneal ulceration, perforation, panophthalmitis, and subsequent loss of the globe itself.[12-15]

Histologically, the extraocular muscles are usually hypertrophied, being enlarged eight to 10 times normal size with an associated edema, round-cell infiltration, degeneration, and later interstitial fibrosis. The orbital fat and connective tissue likewise show edema and round-cell infiltration. However, cases have been reported in which the muscles appeared essentially normal with marked change in the orbital fat and connective tissue, and conversely in which there were marked changes in the muscles but very little obvious increase in the other structures. In experimental animals essentially the same pathologic processes have been reproduced consistently in thyroidectomized guinea pigs later injected with anterior pituitary extract.[16]

The pathogenesis of the disease is unknown. In brief, our present knowledge tends to support the theory that the exophthalmos produced in experimental thyroidectomized animals is caused by the synergistic

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* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital. Presented at the Wilmer Residents' meeting, April 19, 1956.

action of several factors of the anterior pituitary, possibly an exophthalmos-producing hormone which is augmented by ACTH acting through the adrenal gland and adrenal steroids.[17–32]

It is the purpose of this paper to describe the treatment of exophthalmic ophthalmoplegia by means of a modified technique of lateral orbital decompression and to discuss some of the indications for performing this relatively benign procedure.

Review of literature

A lateral approach to the orbit for the removal of a deep-seated orbital tumor was devised by Krönlein in 1888.[33] However, Dollinger, in 1911, was probably the first to describe a decompression procedure for progressive exophthalmos.[34] While he reported no complications, he stated that the operation should only be performed if there was conjunctival chemosis but before the occurrence of corneal ulceration. In 1912, Tinker performed a modified Krönlein procedure for exophthalmos in which he resected a portion of the lateral wall and removed orbital fat.[35]

In 1931, Naffziger reported his transcranial orbital decompression, an operation which alerted the medical profession to the advantages of decompression of the orbit for progressive exophthalmic ophthalmoplegia.[36, 37] Naffziger removed the roof and lateral wall of the orbit through a transfrontal intracranial approach, splitting the superior rectus and levator muscles to open the annulus of Zinn. Later, he modified the procedure to increase the area of decompression.[38] In this, he removed the lateral wall back to the middle cranial fossa and, if there was evidence of swelling in the nerve, occasionally unroofed the optic foramen. Following this, a number of reports of successful decompressions appeared in the literature using the Naffziger technique.

Swift, in 1935, reported a method of decompression with a temporal approach in which the lateral wall and great wing of the sphenoid were removed to the middle cranial fossa along with a portion of the roof.[39] Kistner, Daily, and others described moderately successful cases in which decompression was performed into the sinuses.[40, 41]

In 1937, Moran and Shugrue reported a technique of lateral orbital decompression in which two cases were discussed. Guyton, in 1946, stated that reports were available in the literature on nine cases of decompression into the temporal fossa. To this, he added five cases in which he utilized a modified technique placing the skin incision within the hairline.[42] Moran, in 1953, reported an additional 15 cases describing his technique and results.[43]

In all of the reported cases of lateral orbital decompression, the results have been satisfactory with rather prompt recession of the globe and only minor and transient postoperative complications. This is in direct contrast to the transcranial approach in which pulsation of the globe, postoperative edema with progression of the exophthalmos, postoperative mental confusion probably from undue elevation of the frontal lobe, meningitis, cerebrospinal rhinorrhea, and even death have been reported.[44]

In the Wilmer Ophthalmological Institute in the past year, seven lateral orbital decompression operations have been performed on five patients. The following technique has been employed in these cases:

Procedure

The operative field is prepared with ether, sterile soap, saline irrigation, and 1:1,000 tincture of Zephiran. Iodine should not be used in the preparation as this may influence the protein-bound iodine (PBI) test for as long a period as six months. General anesthesia, usually sodium pentothal, is employed. To protect the cornea, the lids are sutured together temporarily with two black silk sutures tied over cotton pledgets or rubber dams to prevent erosion through the skin. Xylocaine, with hyaluronidase and four drops per 20 cc. of 1:1,000 adrenalin added,

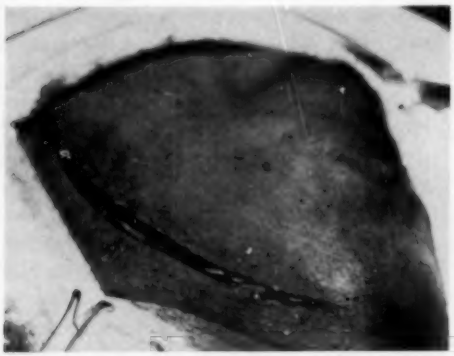

Fig. 1 (Knauer). Skin incision within hairline.

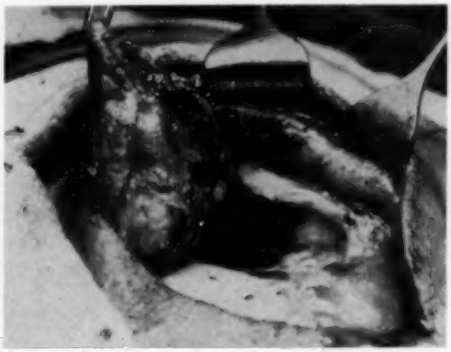

Fig. 3 (Knauer). Exposed temporalis muscle and temporal fossa.

is injected into the temporal fossa and along the line of the incision.

A curved skin incision, six to eight cm. in length, is then made just inside the hairline in a manner similar to that described by Guyton (fig. 1). The skin is undermined widely up to and exposing the entire lateral orbital margin, care being taken not to invade the temporalis fascia or to disturb the branches of the facial nerve which transverse the fatty tissue overlying the fascia. Hemostasis is achieved with plain catgut ties, diathermy, and bone wax. With retraction of the skin flap, the lateral orbital margin is easily exposed.

The periosteum is incised along the entire lateral orbital rim starting at the maxillary zygomatic junction. This incision is curved superiorly and laterally toward the original incision to include the temporalis fascia at the superior aspect of the temporal fossa (fig. 2). The periosteum is then elevated to expose the temporalis muscle and the fossa (fig. 3). That portion of the temporalis muscle lying in the fossa is separated from its fascia (fig. 4) and excised. The zygomatic tubercle is then removed to allow better exposure (fig. 5) and a large portion of the great wing of the sphenoid is removed with hammer and chisel (fig. 6) to allow a larger area for decompression. A Stryker saw with a dacryocystorhinostomy blade is used to enter the lateral orbital plate. The remainder of the lateral wall is removed with rongeurs, leaving a bony opening which measures approximately 30 mm. by 30 mm.

Fig. 2 (Knauer). Incision of periosteum and temporalis fascia to expose temporal fossa.

Fig. 4 (Knauer). Separation of temporalis muscle from the temporal fascia.

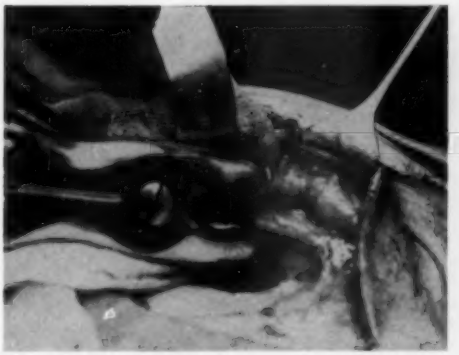

Fig. 5 (Knauer). Removal of zygomatic tubercle.

Fig. 7 (Knauer). Orbital contents decompressed into temporal fossa with digital pressure.

The bone is removed anteriorly to the lateral orbital rim, inferiorly to the inferior orbital fissure, posteriorly to the innermost table of the great wing of the sphenoid, and superiorly to the body of the frontal bone flush with the roof of the orbit. Care is taken not to traumatize the infraorbital nerve.

The periorbita in most cases is under extreme pressure and the orbital fat will protrude during the removal of bone. If this does not occur, the periorbita should be carefully incised, care being taken not to involve any of the orbital contents. From this point in the procedure until the pressure bandage is finally applied, an assistant should keep constant gentle pressure on the orbit over the closed lids to decompress the orbital contents into the temporal fossa as far as is possible (fig. 7).

One or two penrose drains are inserted in the temporal fossa and the temporalis fascia is re-approximated loosely with two or three interrupted black silk sutures. The skin is closed and a pressure bandage is applied over a sponge on the eyelids (fig. 8). Pressure is usually maintained for a period of one week.

After return to the ward, the patient may be allowed to be up as desired, the drains are removed in two days, and the sutures on the fifth to seventh postoperative day. If a bilateral procedure is indicated, the opposite side can usually be operated upon two weeks or more after the initial operation.

Fig. 6 (Knauer). Removal of a portion of the great wing of the sphenoid to allow a larger area for decompression.

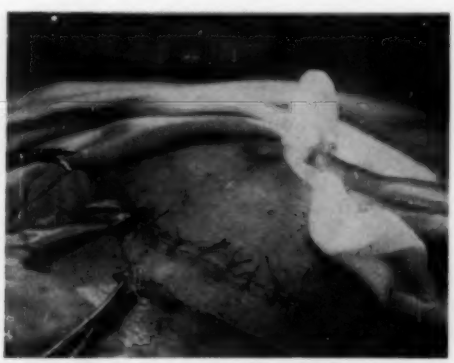

Fig. 8 (Knauer). Insertion of penrose drains and closure of skin incision.

Two important points in this procedure are (1) the complete excision of temporalis muscle from the temporal fossa so as to create an area into which the orbital contents may decompress and (2) the removal of a large portion of the great wing of the sphenoid to allow a greater area for decompression. There is usually very little postoperative reaction and almost maximum recession in exophthalmos occurs within the immediate postoperative period. This technique provides an adequate decompression without the complications which one may encounter with the transfrontal intracranial approach.

Case reports

The five patients operated upon at the Wilmer Ophthalmological Institute with the technique just described had an average decrease in exophthalmos of seven mm. The maximum recession obtained was 11 mm. and the minimum, four mm. Two of these patients were operated for purely cosmetic reasons. This seems justifiable with the temporal approach if the patients understand that they are to undergo a major surgical procedure and the results which may be expected. All of these patients are cosmetically crippled and a recession of proptosis is of great benefit to them subjectively and objectively.

Case 1 (J.H.H. 694988)

M. B., a 39-year-old Negress, developed symptoms of hyperthyroidism with associated prominence of the eyes one year prior to orbital decompression. She was treated with Tapazole. Five months after the onset of therapy, exophthalmos began to progress with eventual associated conjunctival chemosis, limitation of extraocular movements, and visual impairment as low as 3/200 in both eyes. A radioactive iodine tracer test revealed euthyroid. Lateral tarsorraphy did not improve the condition. Vision and chemosis improved on cortisone therapy but, since the patient was diabetic with a lung lesion suggestive of tuberculosis, prolonged cortisone therapy was inadvisable. Preoperative exopthalmometer measurements were 33 mm. in the right eye and 34 mm. in the left eye. An orbital decompression was performed on the left. Postoperatively, there was very little reaction and a marked decrease in proptosis. After an uneventful interval of two weeks, the right orbit was decompressed. At the time of discharge, there was a decrease in exophthalmos of 10 mm. on the right and 11 mm. on the left (fig. 9).

Case 2 (J.H.H. 729766)

L. S. was a 52-year-old white woman who developed hyperthyroidism 13 years prior to orbital decompression. Following a thyroidectomy, unilateral progressive exophthalmos developed, with associated diplopia and limitation of extraocular motions. This became stationary in six to eight months and has remained essentially the same since. She has received no thyroid medication since surgery. Two muscle operations were performed elsewhere three and two years ago. Preoperative exophthalmometer measurements were 21 mm. in the right eye and 33 mm. in the left eye. The proptosed left eye was almost completely fixed. An orbital decompression was performed for cosmetic reasons. Postoperatively, there was no change in the extraocular muscle movements but there was a decrease in proptosis of five mm. (fig. 10).

Case 3 (J.H.H. 674211)

G. R. was a 68-year-old Negress who developed hyperthyroidism 22 months prior to surgery. She was treated with propylthiouracil and later radioactive iodine (I^{131}) several times until euthyroid. Approximately 14 months after onset of therapy her exophthalmos started to progress, associated with conjunctival chemosis and limitation of extraocular movements, especially upward and lateral gaze. Also, there was marked lid retraction and lid lag. Preoperative exophthalmometer readings were 28 mm. in the right eye and 33 mm. in the left eye. A lateral orbital decompression was performed on the left orbit. Postoperatively there was only minimal reaction and marked reduction in the proptosis. Fourteen days after the decompression on the left orbit, a similar procedure was performed on the right orbit. Again there was very little postoperative reaction and on discharge her exophthalmometer readings were 23 mm. in both eyes. Also, there was improvement of the extraocular movements (fig. 11).

Case 4 (J.H.H. 207932)

E. McD., a 42-year-old Negress, developed unilateral proptosis 11 years prior to orbital surgery. The diagnosis of hemangioma of the orbit was made and the patient received 2,100 r (air dose) of X rays through two portals to the right orbit in divided doses. Following roentgen therapy, there was no change in the proptosis. Approximately one year later, the left eye began to protrude and the patient was found to have an elevated basal metabolism rate. She was started on propylthiouracil therapy which she continues to take. At the time of left orbital decompression, the bilateral exophthalmos had been stationary for approximately nine years but was a definite cosmetic blemish and the patient wore large dark glasses constantly. Postoperatively, there was a decrease in proptosis of four mm. and slight cosmetic improvement.

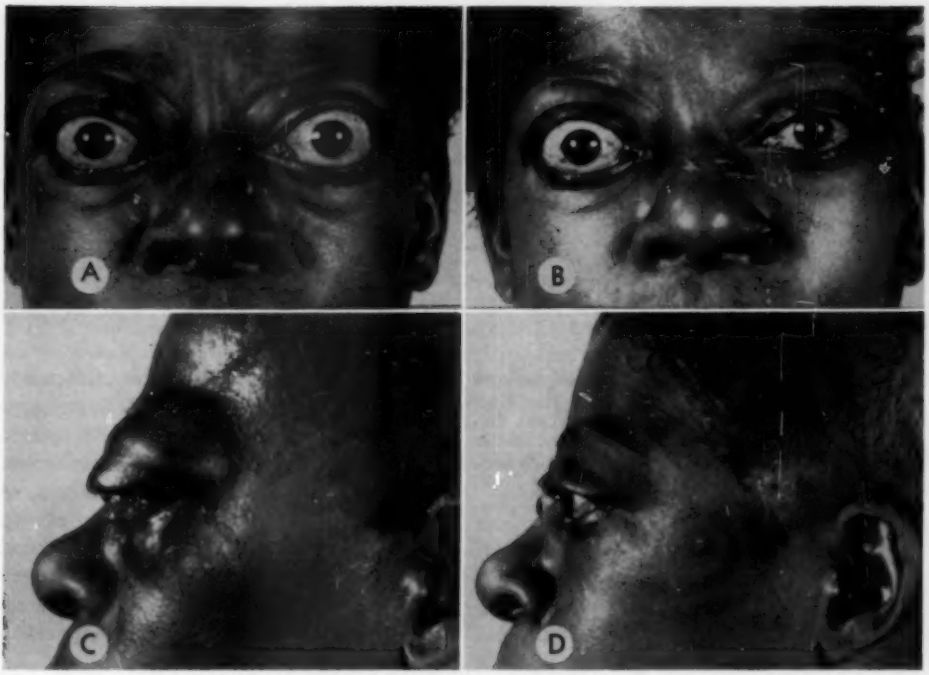

Fig. 9 (Knauer). Case 1. (A) Preoperative appearance. (B) Postoperative appearance 10 days after left lateral orbital decompression. (C) Lateral view preoperatively. (D) Lateral view postoperatively.

CASE 5 (J.H.H. 700194)

V. M., was a 44-year-old white woman on whom a lateral orbital decompression was performed because of diplopia of three and a half months' duration. Fifteen months earlier, the patient had developed classical signs of Graves' disease and was placed on propylthiouracil and Lugol's solution. Nine months after the institution of medical therapy the eyes began to protrude quite rapidly, the left more than the right. Diplopia and limitation of upward gaze were noted three and a half months prior to decompression and the patient could not abduct the left eye beyond the midline for at least one month prior to surgery. Preoperative exophthal-

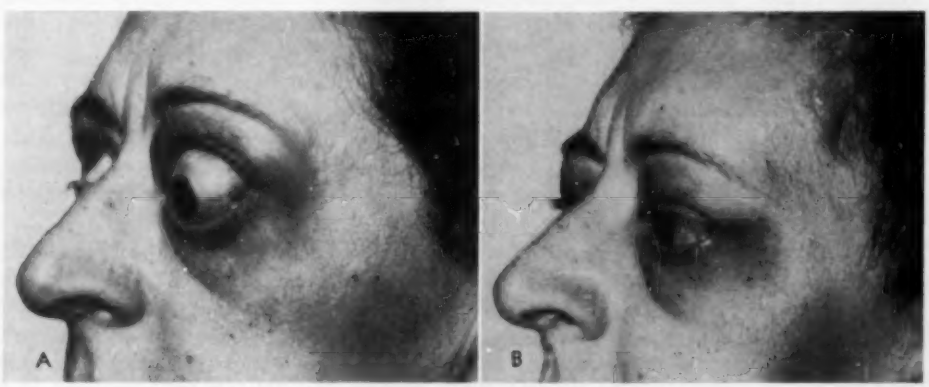

Fig. 10 (Knauer). Case 2. (A) Preoperative appearance. (B) Appearance 10 days after left lateral orbital decompression.

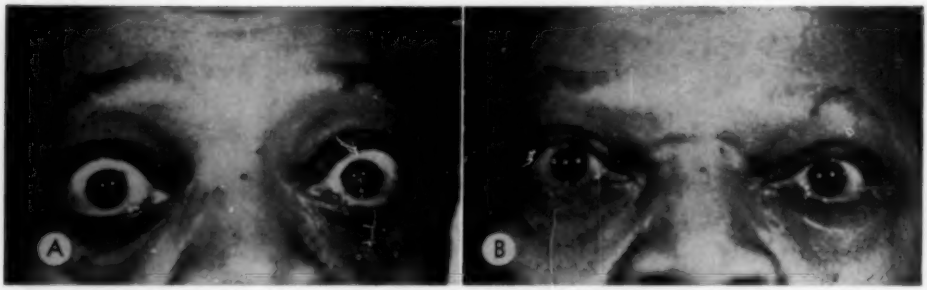

Fig. 11 (Knauer). Case 3. (A) Preoperative appearance. (B) Appearance three weeks after left lateral orbital decompression and one week after right lateral orbital decompression.

mometer measurements were 20 mm. in the right eye and 22 mm. in the left eye. The postoperative course was uneventful and the patient was discharged on the seventh postoperative day with a reduction in proptosis of five mm. There has been only slight improvement in the extraocular movements but the patient has been followed postoperatively for a period of only three weeks.

Discussion

What are the indications for lateral decompression, and at what stage of the disease should operation be performed? The general policy of most ophthalmologists and internists in the past has been one of watchful waiting unless there is corneal involvement or marked visual impairment. This is understandable if the transcranial approach were the only type of decompression available. However, it should be noted that a number of eyes have been lost and ocular cripples created because of this watchful waiting policy. Since a relatively benign operative procedure to relieve these patients is available, a change from the policy of watchful waiting seems indicated.

In reviewing the literature, several important facts are immediately evident. The first is the rather consistent finding that the majority of these unoperated patients do not get a complete return of normal ocular function. A good example of this is found in a recent report of Hedges and Rose in which they studied 19 patients with progressive exophthalmic ophthalmoplegia who were followed from one and a half to 20 years.[45] In 11 of these patients, no significant recession from maximum levels occurred during the period of observation of two to 12 years. In eight patients, recessions varying from three mm. to seven mm. occurred in from one to six years (average of four years). However, no patient showed a return of so-called normal levels! It should also be pointed out that, when the muscle palsies have been stationary for a number of years, only a cosmetic improvement can be expected from decompression.

A second important fact is the experimental and clinical evidence which suggests that the muscle changes in exophthalmic ophthalmoplegia are partially due to the exophthalmos rather than to a primary change within the muscles. Smelser has reported an ingenious experiment, the results of which he summarizes by stating that the edematous infiltration and hypertrophy of the orbital fat found in exophthalmos in thyroidectomized animals are primary changes and are not induced secondarily either by the intraorbital pressure or by the exophthalmos. However, the hypertrophy of the extraocular muscles which occurs in this type of exophthalmos may in part be secondarily induced by the exophthalmos.[46,47]

This premise is supported clinically by the fact that a patient with a very tight orbital septa and a resultant marked resistance to digital pressure will develop extraocular muscle palsies early, rather suddenly, and without severe proptosis. On the other hand, some cases with rather marked

proptosis do not develop extraocular palsies. In these, there is usually protrusion of orbital fat through the orbital septum and much less resistance to posterior displacement of the globe. This suggests that the severe orbital pressure has in part been released through protrusion and proptosis.

There are several series of cases reported in the literature in which orbital decompression has been performed primarily for diplopia. In Guyton's series, the diplopia disappeared in 13 out of 18 reported cases in from several weeks to several months. He does state, however, that the improvement may in considerable part have represented a remission of the metabolic disorder or gradual readjustment of visual function. However, if the changes in the extraocular muscles are in part due to the increased intraorbital pressure, then early lateral orbital decompression seems indicated in these cases.

Summary

1. Exophthalmic ophthalmoplegia is a syndrome, the exact pathogenesis of which is unknown. It can produce proptosis, ocular palsies, diminished or complete loss of vision, and, in severe cases, loss of the globe.

2. It has been shown that adequate orbital decompression can be obtained either via the lateral or transcranial approach, although the latter procedure is the most formidable.

3. The general policy of watchful waiting in many of these cases has resulted in a number of ocular cripples and lost eyes.

4. Late orbital decompression results in cosmetic improvement only and has no effect on the extraocular muscle palsies.

5. There is experimental and clinical evidence which suggests that the changes in the extraocular muscles may be in part secondarily induced by the increased orbital pressure or exophthalmos.

6. Assuming that an adequate trial of medical treatment has failed, it is suggested that patients with exophthalmic ophthalmoplegia who develop any signs of extraocular muscle palsies or evidence of visual impairment undergo a decompression, preferably through the less formidable but adequate lateral approach.

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ELECTRORETINOGRAPHY*

An evaluation of the influence of the retinal and general metabolic condition on the electrical response of the retina

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Rotterdam, The Netherlands

Introduction

When in June, 1953, Dr. Burian asked me to present on this symposium the subject of electrical responses of the retina, I hesitated only a short time before accepting this distinguished invitation.

The opportunity was very attractive to discuss the many problems of clinical electroretinography which arise daily, with one of the few ophthalmologists who is pioneering, as I am, in this relatively new field of ophthalmology.

As Burian[1] stated, and I am of the same opinion, "electroretinography is not primarily a diagnostic tool. At present its chief clinical value lies in the fact that it may be helpful in establishing the prognosis in certain cases. But it will not achieve its full clinical significance until functional electroretinographic tests have been developed."

In the following pages I hope to present some facts for the determination of the place of electroretinography in the armamentarium of the clinician and to prove the right of existence of this recording technique. Though I do not intend to describe in detail the recording technique which is in use in the various clinics, it seems to be important to mention the development of some new refinements in the recording technique aiming at an increase in the usefulness of the electroretinographic examination.

I shall not review the literature, as several reviews have been published already (from the Iowa City clinic, for example, that of Bounds[2]) and the electroretinographic literature is increasingly daily. The majority of the papers, however, are not concerned mainly with the clinical aspects of electroretinography so that it seems justifiable to emphasize this field especially.

Special attention will be paid to the influence of the metabolism, both retinal and general, on the development of the electrical response of the retina. Most of the material presented is from my own data, gathered in the last six years and consisting of over 4,000 cases.

Factors influencing the electrical response of the retina

The factors which influence the electrical response can be enumerated as follows:

a. *Stimulus.* Variations in the response occur under the influence of alteration in duration, intensity, wavelength, and frequency of the stimulus.

b. *Retina.* Variations in the response occur following alteration in field of illumination, adaptation, and metabolic condition of the retina.

Of these different factors, some need a more detailed discussion.

Variation in duration of stimulus light

Due to the use of light flashes of short duration, the electroretinogram has been simplified by the removal of the component, P I. As more and more stroboscopic light flashes of very short duration are being introduced in clinical electroretinography, the c-wave of the electroretinogram is becoming less important for the clinician.

Variation in intensity of the stimulus

It has been shown that, within certain limits, the b-wave is approximately proportional to the logarithm of the stimulus inten-

* Presented at the International Symposium on Physiology and Pathology of the Eye, Iowa City, Iowa, September, 1954.

sity (Riggs[3]). Using stimuli of very high intensity, for instance stroboscopic light flashes, the b-wave decreases considerably in height, owing to the steep increase of the component P III, the a-wave of the electroretinogram (Karpe and Tansley,[4] Burian[5]). In Figure 1, taken from the publication of Burian, this is illustrated quite clearly. Some difference of opinion exists, however, regarding the use of these high intensity flashes in clinical electroretinography. In Karpe's opinion—I think I agree—it seems useful to choose the intensity of the flash in such a way that the a-wave is visible only under pathologic circumstances. However, it is clear that the a-wave may give us further information. From this point of view the use of stroboscopic light flashes is most important. At the same time, reduction of the intensity to subnormal values may also give us new information, as Burian found a more pronounced decrease in the electrical response of the affected eye, using neutral filters, than in the normal eye. In my opinion, we have to consider this refinement of the technique as an important tool in clinical electroretinography.

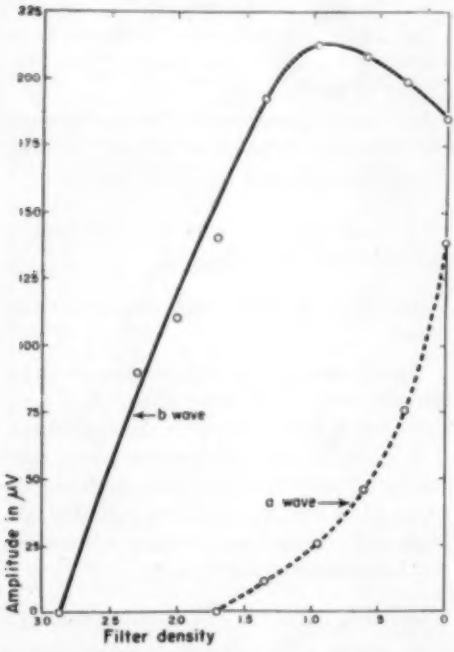

Fig. 1. (Henkes). Amplitudes of a- and b-waves of dark-adapted eye resulting from stimuli of increasing intensity.

Variation in wavelength of the stimulus

The relation between b-wave and the logarithm stimulus intensity holds good not only for "white" light, but also for monochromatic lights, as was stated by Riggs. In Figure 2, taken from an earlier publication (Henkes and Rottier[6]), this relationship is clearly illustrated. A maximum b-potential cannot be surpassed, even when use is made of even higher stimulus intensities (see curves for lambda: 436 and 546 milli mμ). In the lower intensities a strictly logarithmic relation exists between the height of the b-potential and the stimulus intensity.

The same relationship is shown using much shorter wavelengths, for example, UV light of 365 milli mμ. However, we reproduced two curves obtained in the same subject after stimulation with lambda 365 milli mμ. Flashes of very different intensity were found to produce an identical b-potential versus logarithm stimulus intensity curve. The experimental conditions, however, had been held rigidly the same: preliminary dark adaptation, frequency, and duration of flashes were equal. Recordings, however, were made within an interval of two days.

I am inclined to assume, as stated before, an alteration in the electrical response following stimuli of a short wavelength under the influence of an altered retinal condition, which alteration could not be found following stimuli of a longer wavelength, during the same experiment.

It is known that the rods are more sensitive to stimuli of short wavelength (blue), whereas the cone system responds more readily to stimuli of a longer wavelength (red). Component P II, the b-wave of the electroretinogram, is related to the rod sys-

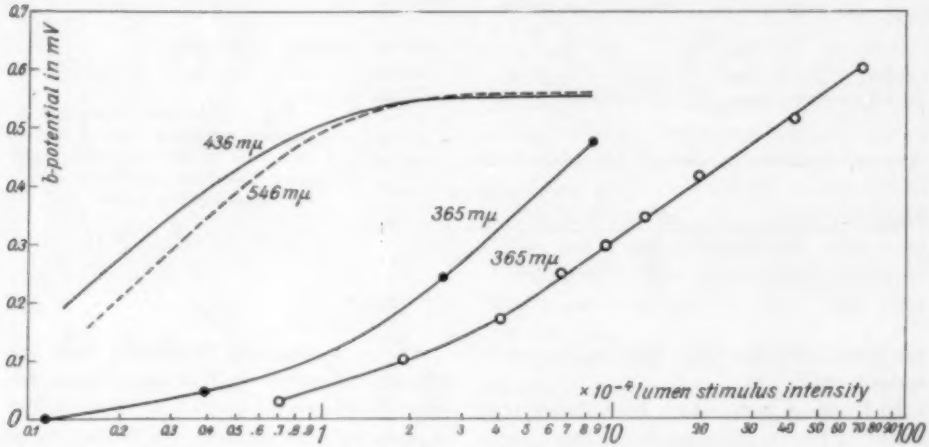

Fig. 2 (Henkes). B-potential versus stimulus intensity for different wavelengths.

tem. Variations in the b-wave can be recorded with a certain degree of exactness. From this, it is understandable that I tried to determine whether it is possible, using blue stimuli, to demonstrate alterations in the b-potential, and thus in the retinal condition, more easily. If this should be the case, it should be possible to make a further refinement in the electroretinographic technique.*

I have been able to show that this assumption holds good. Even in cases in which "white" and orange and green stimuli show a fully normal electrical response, a marked alteration in b-potential using blue stimuli may be found. The stimulus intensities of the different wavelengths and of the white light have been chosen arbitrarily so as to give the normal subject an identical b-potential. The height of the b-potential has been chosen so as to fulfill the relationship between the b-potential and logarithm stimulus intensity.

In Figure 3 the results of such an investigation are given in a case of chronic simple glaucoma. Though the white and green stimuli show minor variations in the b-potential in both eyes, the blue stimulus shows major alterations in the response of the left eye. In my opinion, this points toward a more severe damage of the retinal neurones than can be concluded from the electroretinogram as normally taken following white stimuli.

Variation in frequency of the stimulus

The influence of the frequency of the stimulus flashes is at least partially related to the state of dark adaptation of the retina. The relative size of the b-wave, according to Burian,[1] is determined by the interruption of the process of restitution within the retina at a certain point with each succeeding stimulation, and is dependent on the given flicker frequency. Though Karpe and his school—to which I feel that I belong—take records at intervals of 15 second between the flashes in order not to disturb the dark-adapting state of the retina, it is in my opinion of equal importance to study, as was done by Burian, the relation between the height of the b-potential of the electroretinogram and the rate of flicker.

The percentage loss in size of b-potential following the increase in stimulus frequency

* After completing this manuscript, I learned that François[7] had used colored filters (blue and green) in an electroretinographic study of diabetic and hypertensive retinopathy.

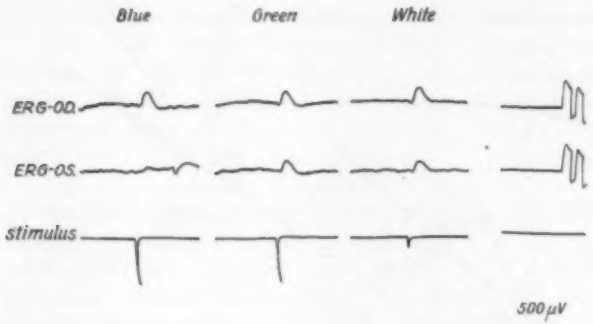

Fig. 3 (Henkes). Electrical responses following colored stimuli in a case of chronic simple glaucoma. Decreased b-potential in left eye following blue stimuli.

has been found not to be identical for white and colored lights.

In Figure 4 curves have been drawn representing two intensity levels for blue, green, and white stimuli. The intensities used have been chosen arbitrarily so as to produce in both investigations an identical b-potential of approximately 400 microvolts and 280 microvolts, respectively, using a stimulus frequency of 0.1 per second.

From the curves it is clear that the percentage loss in height of the b-potential is highest in blue, whereas green and white stimuli show approximately an identical loss. In the right-hand figure, I reproduce the data of the loss of b-wave curve, adapted from Burian.[1] (Curve □ — □).

As can be seen from this figure, there is a definite difference in b-potential even between flashes of 0.1 and 1.0 per second. The importance of separating the flashes by at least 10 to 15 seconds in order to obtain a maximum b-potential has already been stated by Karpe.[8] The percentage loss in b-potential between flashes of 0.1 and 1.0 per second was found, for the 400 microvolts level to be for white: 12 percent; for green: 16 percent; and for blue as high as 25 percent. For the 280 microvolts level these percentages are even higher: 21, 18, and 34 percent, for white, green, and blue stimuli, respectively.

An example of some pathologic curves is given in Figure 5, obtained in the pa-

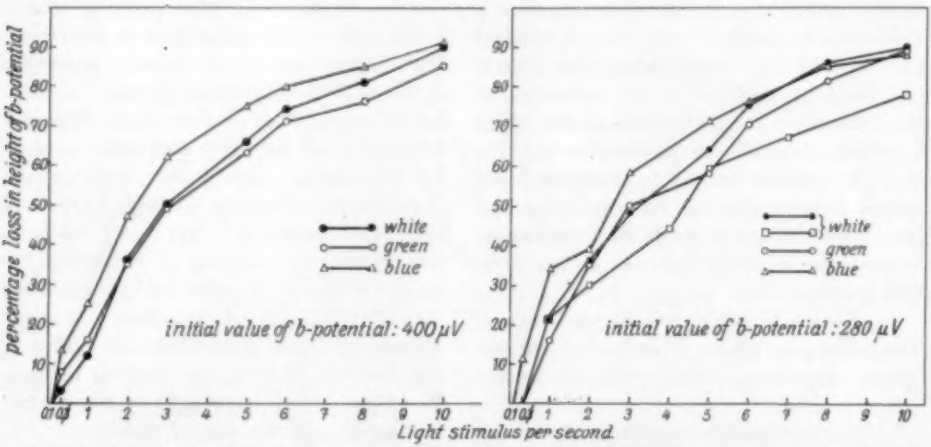

Fig. 4 (Henkes). Curves showing percentage loss in height of b-potential with increasing stimulus frequency of different colors for two intensity levels.

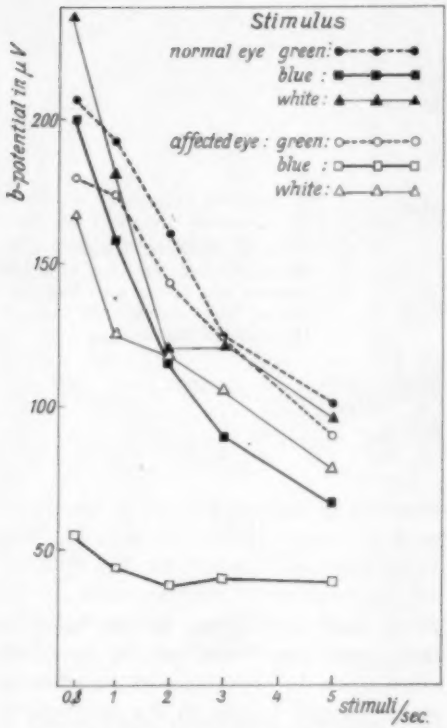

Fig. 5 (Henkes). Curves showing percentage loss in height of b-potential in the case described in Figure 3.

tient already described in Figure 3. The white and green curves for right and left eye are normal, as in the blue curve for the right eye. In the left eye, however, a pathologic curve following stimulation with blue light is found.

Closely related to the above-mentioned facts is the recording of the objective flicker fusion frequency. Until now, however, it is extremely difficult to judge the exact point of fusion in the electroretinogram. The more the subjective critical frequency of fusion is regarded as a sensitive method of appreciation of the retinal condition, the more we need a really objective method to determine the critical flicker frequency. We are unable to state that the solution of this problem has been found.

Variation in the adaptive state of the retina

According to the Karpe school, a preliminary dark adaptation of five minutes should suffice before the recording is started. From the compared curves of subjective dark adaptation and height of the b-potential as published by Karpe and Tansley, one could deduce that it was advisable not to start the recording of the electroretinogram before 40 minutes have elapsed. This is not necessary, however, as:

a. There is no preliminary bleaching of the retina (in most cases the patient is semi-dark adapted for about a quarter of an hour before recording starts) and

b. The stimulus strength is of such a height that even the not totally dark adapted retina will produce a maximum response.

It has been shown, however,[9,10] that, owing to the metabolic condition of the retina, it is advisable to extend this period of rest and dark adaptation up to 30 minutes. Especially in arteriosclerosis of the chorioretinal as well as the general circulation, the increase in electrical response may be surprising. Even when, following white stimuli, the b-potential of the electroretinogram does not show any alteration after the extension of the prerecording period up to 30 minutes, it may be possible to find such a change in the blue response.

In Figure 6 the electroretinograms are given following stimulation with white, green, and blue light. The patient described suffered from a hypertensive retinopathy, grade II, showing an identical fundus picture in both eyes. Following the period of five minutes' dark adaptation, the blue response is definitely lower than the green and white ones. After a prolonged rest in the dark, the blue response showed a marked improvement in the left eye, where even normal values could be recorded. On the other hand, there was no improvement in the right eye. In my opinion, there existed an impairment of the metabolic condition of

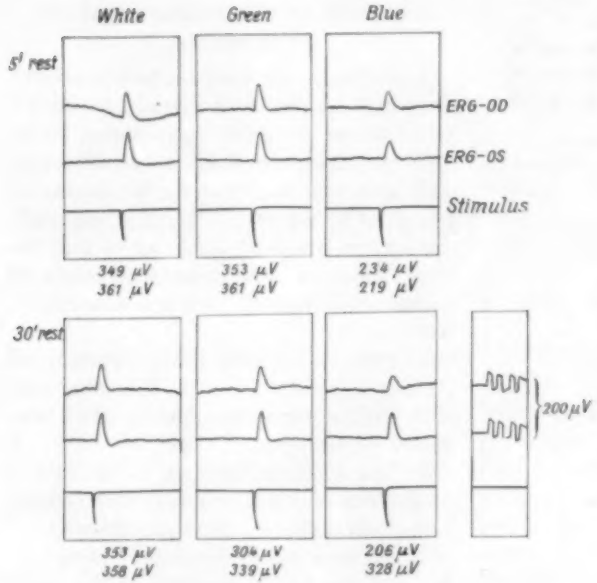

Fig. 6 (Henkes). Variation in b-potential after five and after 30 minutes' rest before recording, following blue stimuli in a case of hypertensive retinopathy.

both retinas, though more pronounced in the right eye.

Influence of metabolic condition of the retina on the electroretinogram

The metabolic condition of the retina and the evaluation of this condition is of the greatest importance in electroretinography. All other factors which influence the various components of the electroretinogram may be chosen according to the demands of the investigator. This is rather difficult as regards the metabolism, and particularly the oxygenation, of the retinal neurones. In this, we depend not only on the condition of the retina locally, but also on the condition of the whole organism. It is fairly difficult to separate these factors. In many cases, a localized disturbance in the retina is associated with troubles in the whole cardiovascular system. It is difficult, as will be clear, to evaluate the share of each in the pathologic electrical response.

The oxygenation of the retina is, at least in my opinion, a decisive factor in the form and amplitude of some of the components of the electroretinogram. In the following paragraphs some facts will be presented which stress the importance of the influence of the oxygen supply on the development of the electroretinograms.

1. Occlusion of carotids

In experiments on the cat's eye, Granit[11] showed that occlusion of the carotid arteries gave a diminution of the b-potential, sometimes preceded by a supernormal b-wave. I, myself, however, was unable to confirm this, though I understand that others, for instance Best,[12] managed to reproduce the results obtained by Granit. It was shown, however, that Granit worked on decerebrated cats in which, I imagine, a considerable loss of blood had occurred, whereas I worked on the intact animal under nembutal narcosis. Intact circulation through the vertebral arteries, without loss of blood, may be able to supply the retinas sufficiently, even in the case of occlusion of the carotid arteries on both sides at the same time.

The preliminary supernormal response in the initial hypoxic phase, described by

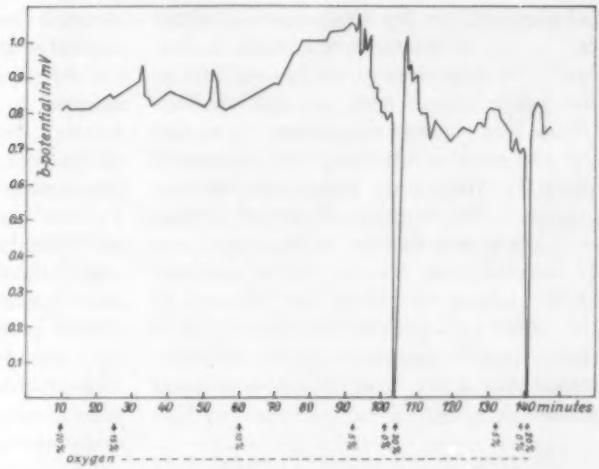

Fig. 7 (Henkes). Influence of variation in oxygen percentage on height of b-potential in the cat's eye.

Granit, is in my opinion due to the initial impairment of the oxygen supply. A raised irritability of the neurones, giving a supernormal response, may be encountered. Restoration of the normal blood supply is able to change this supernormal response into a normal one.

2. Diminution in oxygen percentage of the inhaled air

An identical reaction may be found when the oxygen percentage of the inhaled gas mixture is reduced. Figure 7 illustrates such an experiment on the tracheotomized cat. A supernormal response is found on breathing a mixture containing 10-percent oxygen, whereas an acute diminution of the b-wave is found when the animal is forced to breathe a five-percent oxygen mixture. Pure nitrogen leads to a quick disappearance of the b-potential, which is at first supernormal. It is clear from this experiment that the supernormal response precedes the subnormal one, thus proving that the subnormal b-potential is found in progressive deterioration of the retinal metabolic condition.

This supernormal response is not found in all experiments. In those cases the subnormal phase follows the normal one directly.

Using a high intensity stimulus of short duration, it can be shown that the a-wave under such circumstances is extremely resistant to low oxygen pressures. Granit suggested the name P III for the a-wave,

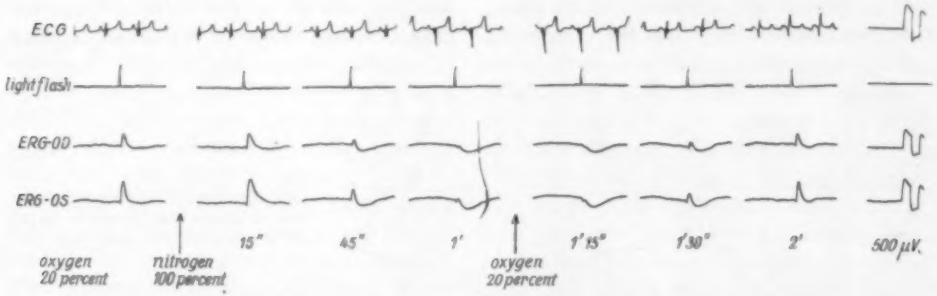

Fig. 8 (Henkes). Influence of decrease in oxygen supply on the a- and b-wave of the electroretinogram of the cat's eye using stroboscopic light flashes. Extreme resistance of a-wave to anoxia.

pointing out that this component is the last one of the electroretinogram which is lost. In Figure 8 the loss of the b-wave following inhalation of pure nitrogen is illustrated. The supernormal response precedes the progressive decrease in b-potential (strip 2). The a-wave becomes increasingly negative. The return to 20-percent oxygen is followed by a decrease in the a-wave and an increase in the b-wave. As the condition of this animal was fairly bad (showed by the pathologic electroencephalogram), it is understandable that the height of the b-potential was lower than in the experiment described in Figure 7.

3. Increase of the intraocular pressure

Bornschein and Zwiauer[13] demonstrated on the rabbit's eye the influence of an increase in intraocular pressure on the height of the b-wave. Not before the pressure had been increased up to 70 to 90 mm. Hg could an alteration in the electrical response be found. A total loss of the response was not encountered until the pressure had been raised up to 100 mm. Hg. It is probable that these alterations in the electroretinogram depend on the variations in the retinal and choroidal oxygen supply. Simultaneously with the decrease of the b-potential, an increase in the latent period of this component could be observed. Even an increased intraocular pressure of 110 mm. Hg during 15 minutes was followed by a complete restoration of the electrical response. In the cat's eye we have found identical results. However, we always met, when the intraocular pressure had been raised sufficiently, a marked a-wave, which proved itself, as in the experiments described above, extremely resistant to any increase in the intraocular pressure. In my opinion, this divergence of results must be ascribed to the difference in illumination technique. Bornschein and Zwiauer used a stimulus of rather low intensity and long duration; we used stroboscopic light flashes of high intensity and short duration.

In Figure 9 the resistance of the a-wave to increased intraocular pressure is illustrated clearly, whereas the b-wave is shown to be highly susceptible to increase of the intraocular pressure beyond a certain level.

Clinical parallels can be found for all three groups of experiments mentioned in the foregoing pages.

Undoubtedly hypoxia as well as anoxia of the retinal neurones may be found as a result of localized impairment of the retina, as well as following general disturbances of the circulatory system.

Localized impairment of the retinal circulation may be due to disturbances in the blood supply: occlusion of vein and artery, hypertensive and arteriosclerotic retinopathy, diabetic retinopathy, perivasculitis retinae, and commotio retinae, to mention only some of the possibilities. Further, a compression of the circulatory system in retina and choroid may be produced by increasing the intraocular pressure, as in glaucoma.

Pathologic processes influencing the arterial and venous in the outflow from the globe, situated intra- or retrobulbarly, may

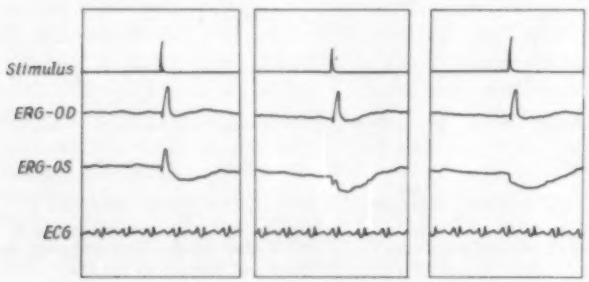

Fig. 9 (Henkes). Influence of increased intraocular pressure on a- and b-wave of the cat's eye.

lead to alteration in the electrical response, as for instance in some cases of papilledema, optic neuritis, tumor of the optic nerve. It is reasonable to suppose that there may be many more examples in which the electroretinogram has been influenced through direct or indirect action on the blood supply of the retina.

General impairment of the circulation may lead to impairment of the retinal response, for example, in arterial hypertension, as well as hypotension and arteriosclerosis. Insufficient oxygenation of the blood in the lungs (for instance in cardiac decompensation) or excessive oxygen consumption by the periphery of the organism to such a degree that the retina is not supplied adequately, may also lead to alteration in the electrical response of the retinal neurones.

In the following pages the results of clinical electroretinography in the various affections already mentioned will be discussed briefly.

Electroretinography in disturbances of the chorioretinal circulation

In a series of articles, published in the *Archives of Ophthalmology*,[9,14-17] I mentioned some of the features of the electrical response found in cases of disturbance of the retinal circulation: occlusion of vein and artery, hypertensive and arteriosclerotic retinopathy.

Diabetic retinopathy

According to François,[7] studying 35 cases of this condition not complicated by hypertensive retinopathy, the electroretinogram is normal, even in cases which show major alterations in the retina. Only in nine cases which were complicated by a hypertensive retinopathy did the response show subnormal values. In cases of retinitis proliferans a subnormal electroretinogram could be recorded. The use of colored filters in 12 cases did not alter the response distinctly. Vasodilator drugs, given intravenously, gave highly variable results.

My own material is too small to allow any definite conclusion. However, as in the cases of atherosclerotic retinopathy described earlier, I found in several cases an alteration in the electroretinogram following the extension of the prerecording period of rest and dark adaptation, pointing in my opinion to the fact that even a normal b-potential is not a proof of a normal retinal metabolic condition.

Perivasculitis retinae

Karpe, in his monograph, has already stated that periphlebitis retinae gave a normal electroretinogram in the early stages, whereas in the advanced stages a negative electroretinogram or even an extinguished electroretinogram has been found. In Figure 10 the importance of an electroretinographic examination is stressed, as it can be seen that the electroretinogram can give reliable information regarding the retinal condition, independent of the visual acuity or visual fields. In the case discussed, a hemorrhage in the vitreous was found several times in the course of the disease. The improving electroretinogram, however, pointed to an improvement of the retinal process as a whole. As was shown later, the affected eye healed with only very slight functional impairment.

Commotio retinae

This condition, due to a traumatic edema of the retina, can be accompanied by a loss in the electrical response. Following the disappearance of the edema, the decreased electroretinogram changes into a normal one (Karpe), or a subnormal electroretinogram may be maintained as a result of a more serious concussion. Figure 11 illustrates this latter condition clearly. Following a contusion of the right eyeball, a subnormal electroretinogram was found. Within three weeks the b-potential gradually increased from 0.09 mV to 0.21 mV. In the fundus oculi irreversible changes could be found. The electroretinographic control, over a

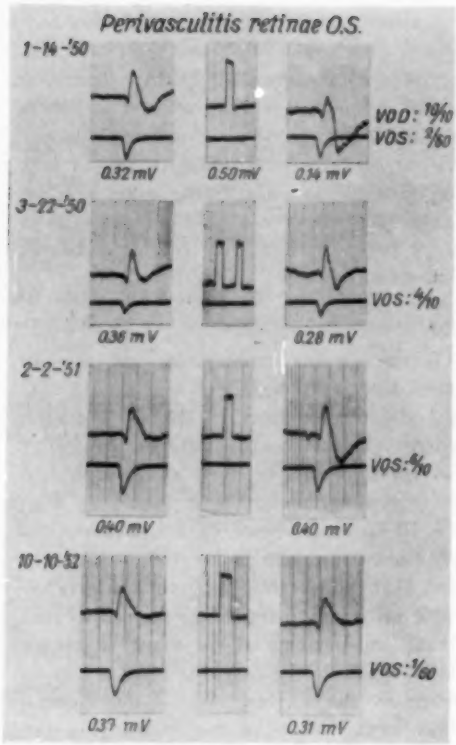

Fig. 10 (Henkes). Electroretinograph in a case of perivasculitis retinae followed over a long period.

period of over two years, proved that the condition had become permanent. In other cases normalization of the electroretinogram can sometimes be found. Apart from alterations in the ocular media, it is possible to judge the condition of the retina objectively using the electroretinographic technique.

Glaucoma

The electroretinogram in cases of chronic simple glaucoma is normal, except in those cases in which we have to assume an atherosclerotic process in the intraocular vessels. Such a process results in a subnormal electrical response, independent of the eventual loss of visual field.[18] In cases of acute glaucoma both supernormal and subnormal electroretinograms have been found (François[19]). The supernormal response may be regarded as a clinical parallel to the experiments described above, in which the intraocular pressure was raised.

In Figure 12 such a case is described. The supernormal b-potential changed into a more or less normal response following an iridectomy. In other cases, the acute stage is marked by the presence of a normal or even subnormal electroretinogram, which can be changed into a normal response following an iridectomy (Fig. 13). In my opinion, it is not the absolute height of the intraocular pressure which may be decisive for the response, but the presence of an impairment of the retinal circulation (slight impairment, supernormal electroretinogram, markedly hampered retinal circulation, subnormal electroretinogram).

As I pointed out before, it may be pos-

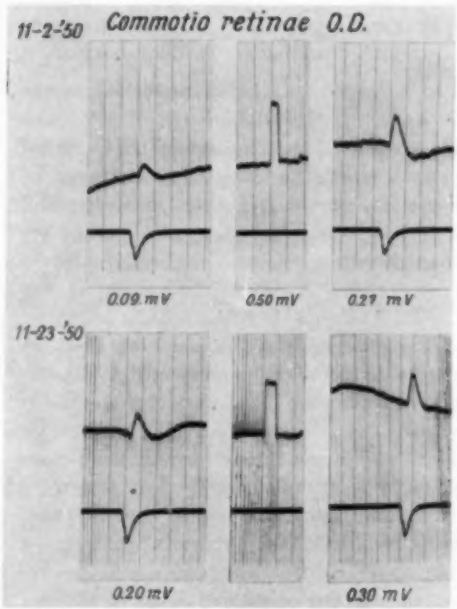

Fig. 11 (Henkes). Electroretinographic responses in a case of commotio retinae.

sible to detect in an earlier stage alterations in the retinal circulation, using colored stimuli. Examples are given in Figures 3 and 5. In this respect it seems to me of great importance to follow the future development of the compression test, designed by Burian.[1] Burian found in preliminary experiments different behaviors in the normal and the glaucomatous eye upon compression of the globe and it is probable that this test will be of importance in the early detection of this disease.

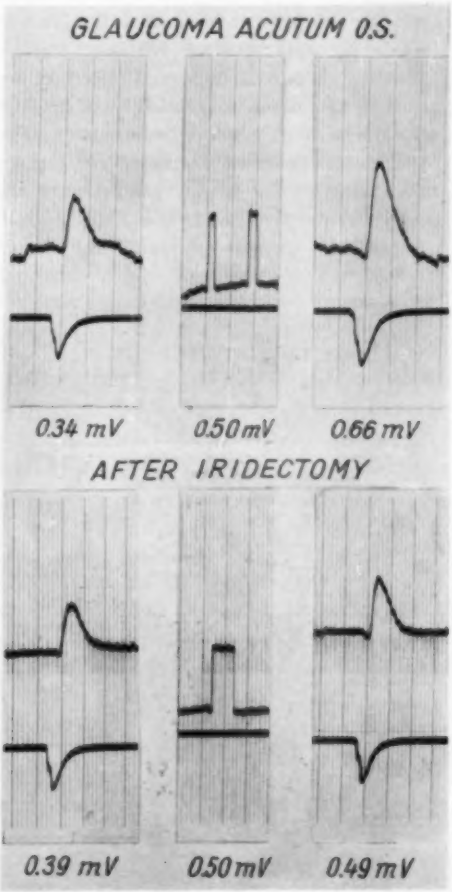

Fig. 12 (Henkes). The electroretinogram in a case of acute glaucoma before and after iridectomy.

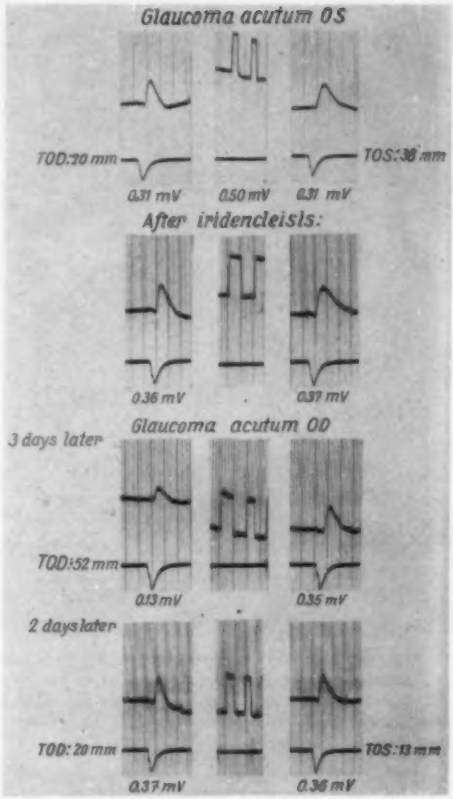

Fig. 13 (Henkes). Electroretinograms in another case of acute glaucoma.

Papilledema

An abnormal electroretinogram cannot be recorded in all cases of choked disc. This depends on the grade of impairment of the retinal circulation. In Figure 14 the electroretinograms are reported of a girl, aged 12 years, showing a progressive exophthalmos and edema of the disc in the left eye, without impairment of visual acuity and fields. In the following months the electroretinogram increased markedly. B-potentials of over 0.60 mV were recorded. After the removal of a tumor of the optic nerve the electroretinogram was found to be totally extinguished. The progressive obstruction of the central retinal vessels by the tumor,

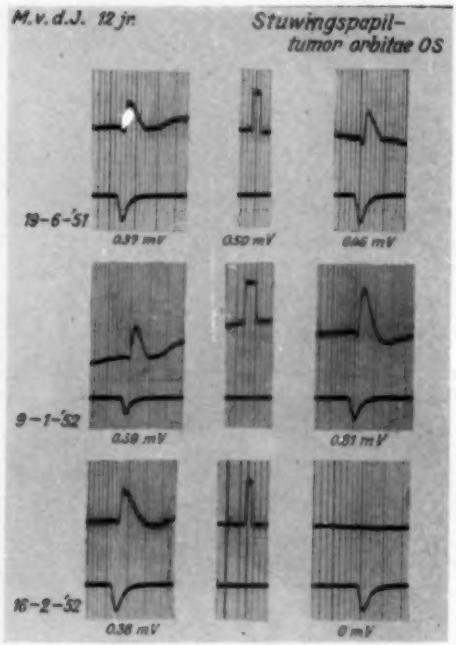

Fig. 14 (Henkes). Electroretinography in a case of glioma nervi optici, before and after removal of tumor. Increased impairment of the retinal circulation leads to increase in the supernormal response of the retina.

which was situated right behind the disc, can be concluded from the increased supernormal responses to the light flash.

Optic neuritis

Karpe stated that in the 10 cases of optic neuritis, described in his monograph, a normal electroretinogram was found. This is not always the case, as is shown by the case report illustrated in Figure 15. In the course of the process, bilateral optic neuritis due to sclerosis multiplex, a supernormal electroretinogram of varying height was found; this supernormal electroretinogram was followed over a period of two years. No impairment of the visual field or of the fundus picture could be found during this period. The visual acuity, however, was deteriorating. I am inclined to believe that this supernormal response may be explained by the existence of an impairment in the retinal blood supply, even though the ophthalmoscope was unable to show any alteration in the fundus picture.

Electroretinography in disturbances of the general circulation

As we described before,[10] general hypertension and general atherosclerosis of the cardiovascular system may lead to alterations in the electrical response of the retina, even in those cases in which the ophthalmoscopic picture is absolutely normal. Generally speaking a supernormal electroretinogram is found in hypertension without arteriosclerosis, whereas a subnormal electroretinogram is found more frequently in arteriosclerosis without general hypertension. The hypertension without arteriosclerosis gives rise, owing to the spastic condition of the vessels frequently found, to a slight impairment of the oxygen supply to the retinal

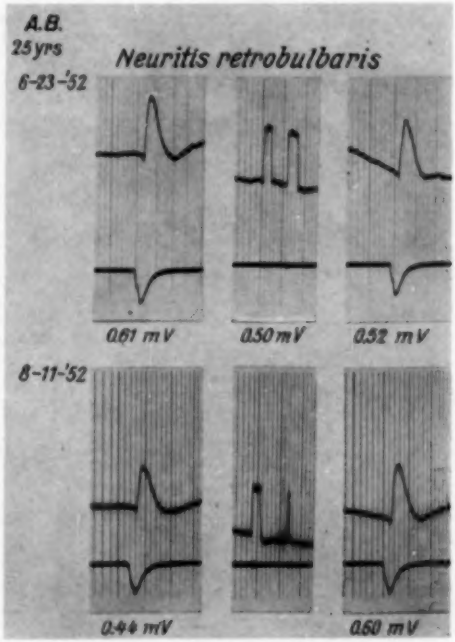

Fig. 15 (Henkes). The electroretinogram in a case of bilateral optic neuritis.

neurones (supernormal electroretinogram), whereas in general arteriosclerosis without hypertension the blood supply may be insufficient due to the narrowing and rigidity of the vessels.

In such cases an additional hypertension may be most useful in furnishing a possibility for sufficient oxygenation of the retinal neurones with, as a consequence, a normal electroretinogram in most of the cases. The withdrawal of the arterial hypertension following antihypertensive therapy may thus lead to disastrous loss in b-potential, pointing to the fact that the oxygenation of the retina is seriously impaired.[17]

In most cases, no further improvement in the b-potential can be found after the prolonged rest of 30 minutes necessary to provide an optimal oxygen supply to the retinal neurones. However, in some cases of marked arteriosclerosis, even a period of one hour may be needed before a stable response can be recorded. This is shown in Figure 16. This patient, suffering from a general arteriosclerosis and a sclerotic process in retina and choroid with macular degeneration, has been observed over a period of several years. Curves have been drawn of the height of the b-potential in both eyes, followed up to one hour after the beginning of the recording, taken with an interval of two years.

It is clear that though the values found after one hour's rest are of the same height in 1951 and 1953, the values found after the usual period of five minutes' rest and adaptation are definitely lower in 1953. We have to assume a deteriorating oxygen supply to the retina, though the ophthalmoscope did not show major alteration during this period.

Curves, shown in Figure 17, were drawn in 1951. From these, it is learned that extramuscular effort (climbing stairs) leads to excessive loss of retinal response resulting from the even more diminished retinal blood supply. (Compare curves ○—○ with ▲—▲.) In rest, a marked improvement in the b-potential of the right eye can be recorded, following an intravenous injection

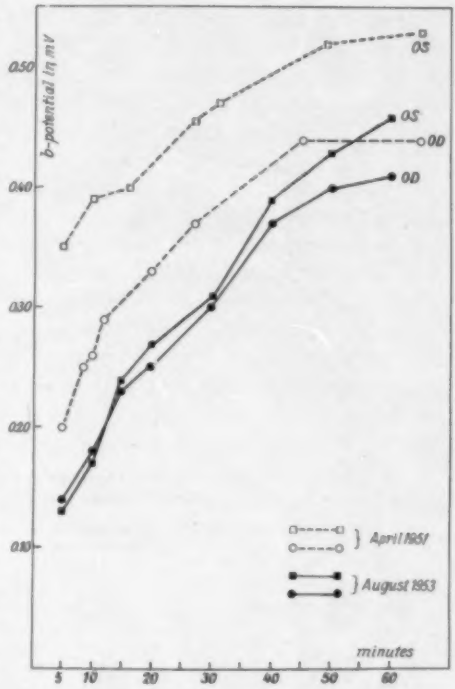

Fig. 16 (Henkes). Electroretinographic responses increase during prolonged rest in the dark room. Curves taken with an interval of two years, in a patient suffering from general and chorioretinal arteriosclerosis.

of a vasodilator drug. The subnormal electroretinographic curves, recorded after the climbing of the stairs, may be improved when a vasodilator drug has been administered beforehand (curves ●—●). The same findings have been reported in cases of general arteriosclerosis without ophthalmoscopic alterations in the retina.[16]

When the retinal adaptation to the dark was maintained fully by occlusion of the eyes, a stable though supernormal electroretinogram could be recorded, even after a walk of 30 minutes' duration (curves □—□). Though the oygen supply to the retinal neurones must have been much impaired, it seems that in this case the fully maintained dark adaptation must have been of greater significance for the development

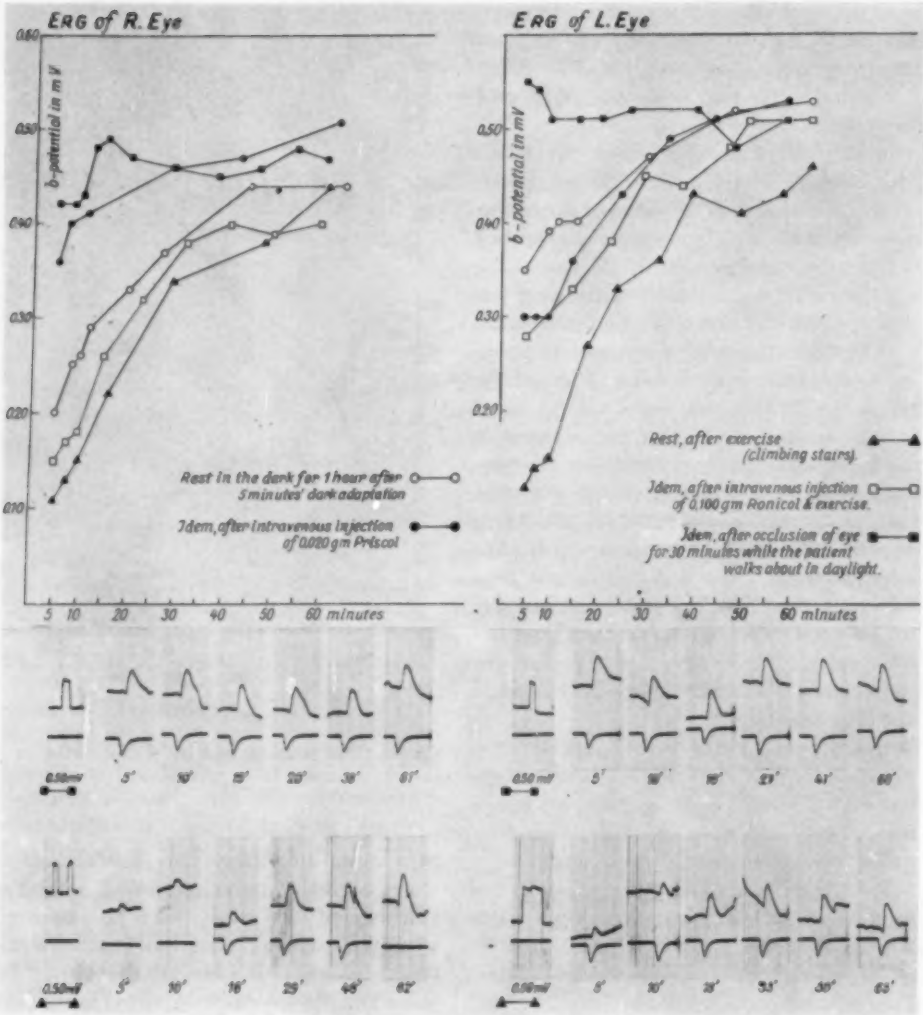

Fig. 17 (Henkes). Curves taken from same patient as in Figure 16. Influence of rest, muscular exercise, and vasodilatation on the electroretinogram of both eyes.

of the electroretinogram. The patient under discussion was fully compensated, and, apart from his general arteriosclerosis, the bulk of his affection was localized in the eyes.

The situation is different when retinal and general circulation are intact but the insufficient oxygenation of the blood is due to cardiac decompensation.

In Figure 18 the electrical response is given in such a case, showing major symptoms of cardiac decompensation without the slightest alteration in the ophthalmoscopic picture. In rest, the electroretinogram recorded was of the supernormal type; in my opinion an expression of the already hampered oxygenation of the retinal neurones.

Even minor physical exercise (changing eight times from a lying to a sitting position)

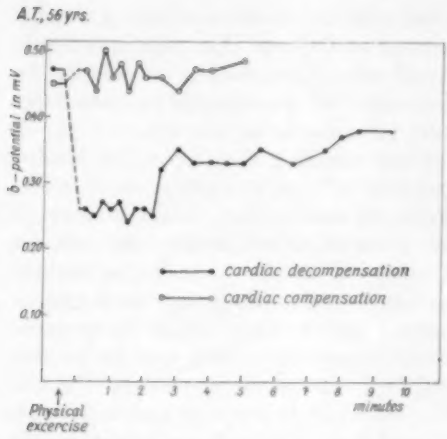

Fig. 18 (Henkes). Follow-up of the electroretinogram in a patient suffering from cardiac decompensation following minor physical exercise. Records of same test after successful treatment of cardiac decompensation.

led to a definite decrease in the response, whereas following successful treatment of the decompensation, the same exercise was unable to alter the electrical response. The amelioration of the oxygenation of the blood is demonstrated clearly.

It is beyond doubt that one may produce more material with the aim of advocating the usefulness of an electroretinographic examination in the judgment of the condition of the retinal and general circulation. The possibilities of this technique are not yet exhausted and I am sure that further developments and refinements will be produced in the near future. It is beyond doubt that in this respect the work which is done in the clinic of Iowa City will be of the greatest future importance.

Schiedamsevest 80.

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Discussion

Dr. P. J. Leinfelder (Iowa City): I am indebted to Dr. Henkes for his discussion and I am going to surprise everyone by talking about the subject—not that I know anything about it but I have followed it since 1935 and since then I have been amazed by its technicalities and by the persistence and intelligence with which the workers in this field carry on. In 1935, I had occasion to look up some literature on electroretinography and as I came along from 1926 to 1932 I came upon an article which said that the authors were very sorry to report that all of their work and publications of the previous five years were incorrect because of technical errors. It was necessary for the workers to begin all over again. As a poor novice, I was very much impressed but at

the time convinced that this was no field for me. I have followed the work of several researchers in this area and I think all of you appreciate that through the late '30s and the '40s there was much controversy as to just what the electroretinograms meant. The problem increased and when an attempt was made to associate the electroretinogram with pathologic conditions in the retina and optic nerve things really became confusing. Today you are seeing that because of the persistence of these investigators who have the true spirit of research, who are not thrown back by obstacles, understanding is broadening and we now can get clinical as well as basic physiologic aid in pathologic conditions.

I want to call on Dr. Burian to say something that has to do with the subject in a thoroughly scientific way.

Dr. Hermann M. Burian (Iowa City): In 1950 one of the gentlemen present here today told me that I should go to Rotterdam to see Dr. Henkes, if I were interested in electroretinography. Unfortunately, I did not have the opportunity to go to Rotterdam. I regretted it then and have regretted it every since, especially as time went on and more and more publications of Dr. Henkes' appeared. So we decided that there was only one thing to do and that was to get him to come over to see us. I am sure that I am expressing the sentiments of everybody present when I say that we are happy that Dr. Henkes accepted this invitation and made the effort of coming to Iowa City to tell us about his vast experience in the field of clinical electroretinography in which he is a pioneer.

Electroretinography offers a test of retinal function. As such, it is potentially superior to a mere inspection of the fundus. It is an objective test and, therefore, has certain advantages, as well as disadvantages, over subjective tests. Clinical electroretinography can be approached from a variety of angles. One way is to set more or less arbitrarily certain standard conditions of stimulation—as was done by Karpe—and to apply the method to a large variety of diseases, noting the differences in response. The other approach is not to set a strict routine, but to vary the parameters of the stimulus in accordance with circumstances of the case.

Following the lead of Karpe, Dr. Henkes originally adhered to rigid standard conditions and chose to pay special attention to one group of retinal diseases—the vascular diseases—which offer, indeed, a particularly promising field for electroretinographic studies. Instead of varying the stimulus conditions, his variables have been the patients and the treatment of the patients. The vast material which he has thus accumulated has allowed him to draw some important conclusions. But lately Dr. Henkes has also felt restricted by the standard conditions and has broadened the scope of his work by increasing the duration of dark adaptation, and by employing high intensity stimuli of short duration as well as colored filters. The results which he has obtained with blue filters seem to me to be of particular significance. The same holds true of his study of the electroretinogram after exertion. These and similar studies point the way to real electroretinographic functional tests.

I should like now to ask Dr. Henkes some questions with regard to the interpretation which he has given to the results obtained in some patients with generalized arteriosclerosis and in patients with hypertensive retinopathy with or without generalized arteriosclerosis. I fail to understand why he thinks that a considerable gain in the electric response of patients with hypertensive retinopathy during dark adaptation is a poor diagnostic sign. Can any retina, which is at all viable, help accumulating visual pigments during dark adaptation? Is it not, on the contrary, a good sign with regard to circulation and the metabolic conditions of the retina when this normal accumulation takes place? To me this has always appeared to be the case. Also, when Dr. Henkes states that subnormal responses in cases of arteriosclerosis without hypertension can be at-

tributed to insufficient oxygen supply to the retinal neurones, one can only agree that this is likely to be so. But it is less clear to me what Dr. Henkes means by saying that the conditions of oxygen supply can be improved best in the dark. I wonder whether this is really well established. Does it not simply mean that in these patients the retinas still function well enough to permit an increase in sensitivity?

These points are minor, and the questions raised do not detract from the really valuable contributions that Dr. Henkes has made to clinical electroretinography on a large scale. As to interpreting our results properly, I have always had some doubts in this respect, and I believe that I am not alone with these doubts. There still are so many unknown, so many unresolved points in the interpretation of the electroretinogram that the clinical evaluation remains doubtful and poses tantalizing problems. The prospect that these problems may some day find a solution is part of the fascination of working in this field. After listening to Dr. Henkes, who has given us today so many and so valuable clinical points in electroretinography, I am beginning to wonder whether my present pessimistic attitude is really justified.

Now the approach to electroretinography which we have chosen in our laboratory, and which I have mentioned before, is more difficult and less promising of immediate results, but I believe that in the long run it may prove to be the road which will lead to making electroretinography a more useful tool in clinical ophthalmology.

In this approach no hard and fast routine is laid down. Rather than restricting oneself to stimulating every retina at a specified time with a stimulus of specified intensity and judging the retinal sensitivity by the height of the b-wave alone, one may elect to vary the parameters of the stimulus and to introduce such functional tests as might seem helpful in accordance with the requirements of the case. The goal in this procedure is to assess the behavior of all the component parts of the electroretinogram rather than only that of the b-wave, and in this approach the individual case looms larger than the statistical evaluation.

I shall not list the many as yet somewhat disconnected results which we have obtained, but will point out only one thing, the behavior of the a-wave. The wave is clearly marked in every electroretinogram when high intensity stimuli of very short duration are employed. It appears to be not simply a photopic response, but a more complex one, and, indeed, may be the expression of an inhibitory factor, as Granit believed. At any rate, it is particularly marked when the retinal sensitivity is low and decreases in size when the sensitivity improves. Dr. Henkes has shown that with reduced oxygen supply in the cat the a-wave becomes larger. We have observed similar phenomena in humans by compressing the globe and in patients with retinal detachment.

A particularly interesting example of the behavior of the a-wave was demonstrated to us in the case of a 66-year-old man with temporal arteritis, and I shall show you some slides summarizing our findings. His right eye had 6/6 vision and a normal field, his left eye had been totally blind for six weeks prior to his first visit to us. The electroretinogram of the left eye presented a subnormal b-wave which did not increase a great deal during dark adaptation, but the size of the a-wave was quite extraordinary. Interestingly enough, the right eye, in spite of its normal vision, gave an electroretinogram which was also abnormal and not distinguishable from that of the left eye. The patient was put on cortisone which not only stopped his headaches immediately, but also improved his electroretinogram. The slide shows you a set of electroretinograms after one and two months, respectively, and you note that there is not only an increase in the b-wave, but also a very marked reduction in the size of the a-wave, so that the ratio $\frac{\text{b-wave}}{\text{a-wave}}$ is now normalized. There was, of

course, no return of vision in the left eye. This case is of importance not only in that it indicates the role which the evaluation of the a-wave may play in judging an electroretinogram, but also in that it gives objective evidence for the improvement of the retinal circulation with cortisone therapy.

I know that we are going in the same direction as Dr. Henkes and share the same fundamental principles and ideas, and I can only repeat that we are most grateful to him for his coming and for the stimulation which he has given us with his excellent presentation.

Prof. G. Schubert (Vienna, Austria): Owing to the introduction of amplifiers and contact lens electrodes, the registration of the electroretinogram of human beings no longer encounters technical difficulties. A number of ophthalmologists have profited by this circumstance in order to examine the clinical usefulness of the electroretinogram. For this purpose the electroretinogram was taken in as many cases as possible of the most varied eye diseases. In so doing as a rule a more or less arbitrarily determined "standard stimulus" was used without considering the possibility that the evidence for certain anomalies might require special conditions of stimulation. Yet the extraordinary importance of the quality of the stimulus is already demonstrated in the case of the normal electroretinogram.

In varying the parameters of the stimulus (intensity, spectral composition, duration, and chronological sequence of the light stimuli) as well as in varying the state of adaptation of the examined eye, different electroretinogram-forms are obtained which are absolutely characteristic for the stimulus conditions employed. Hence new possibilities arise for clinical electroretinography which, however, can only be made full use of, if one preliminary condition is met: the electroretinogram components, which can be differentiated by various stimulus conditions, must be known as to their functional significance and structural co-ordination. Only on this basis can a rational examination technique be developed, by which a meaningful diagnostic assessment of deviations is made possible. Though these physiologic principles of the electroretinogram may still be unclear or disputable today in many respects, yet several essential facts have been established in independent investigations.

The simple positive deflection (b-wave), as registered with medium stimulus intensities used clinically thus far, represents doubtlessly a purely scotopic function. This is substantiated by its dependence on the state of adaptation as well as by its spectral sensitivity. Of particular importance is the fact that only minimal b-waves are produced even with light-intensities lying four or five log units above the subjective threshold. Analogously the photopic components become only demonstrable in the electroretinogram with correspondingly higher intensities. Their isolation requires elimination of the scotopic function by light-adaptation or red stimulation.

Under these circumstances a positive deflection appears (x-wave) which differs from the b-wave by its shorter latency and shorter duration. Described for the first time by Motokawa and Mita in 1942,[1] it has been confirmed and analyzed since that time by several investigators. Researches of late have furthermore shown that the negative wave (a-wave), occurring with intensive white light stimulations and preceding the x- and b-waves, is by no means purely photopic as is still often assumed. It is divided into two sections, sometimes distinctly separated by a stage which—according to their spectral sensitivity and characteristics of adaptation—belong to the photopic and scotopic system, respectively. From all these facts it can be gathered that the scotopic as well as the photopic components of the electroretinogram have a positive and a negative phase. It will be noticed, in addition to the mentioned differences of their time characteristics, that in the scotopic component the positive phase is prevalent, while in the photopic component the negative phase predominates.

These conclusions are fully confirmed by

findings in cases of certain congenital ocular abnormalities. With congenital hemeralopia (deficient rod function) the b-wave is missing with all stimulus conditions and the predominantly negative electroretinogram consists exclusively of an a-wave and an x-wave. The situation is exactly opposite in congenital rod-monochromatism (deficient cone function). In this case the electroretinogram consists of a small a-wave as well as of the b-wave, whereas x-wave and photopic component of the a-wave are missing. With protanopia (reduced red sensitivity) no demonstrable x-wave can be produced by red light. Finally, it must be mentioned that the marked rise of rod- and cone-threshold in cases of hemeralopia due to vitamin A-deficiency is associated with the falling off of all scotopic and photopic components of the electroretinogram which thus appears completely extinguished.

The identification of photopic and scotopic components, though rendering possible a functional analysis of the electroretinogram, nevertheless does not tell anything about the localization of the generators of the potentials. Conclusive evidence on this subject cannot be furnished by the human electroretinogram, although a participation of the retinal ganglion cells seems unlikely because of some reports, such as these about the partial persistence of the electroretinogram with pressure amaurosis. All the more important are the experiments deriving the electroretinogram by means of microelectrodes from particular layers of the animal retina. While such studies by Tomita and collaborators[2] had already shown the receptors to be essentially involved, the results obtained by Ottoson and Svaetichin[3] with ultramicroelectrodes (diameter 0.05 μ) even speak in favor of an exclusive origin of the electroretinogram in the receptor layer. To what extent findings, made on isolated fish and frog retinas, may be applied to the complicated human electroretinogram must be left undecided for the time being.

Also as yet not completely clarified is the functional relationship between electroretinogram and action potentials of the optic nerve, such as can be derived in animals from the intracranial section of the nerve. Until quite recently the spikes obtained with Granit's microelectrode technique from the cat's retina were also considered as action potentials of the optic nerve.

Rushton,[4] on the other hand, could demonstrate that the spikes in question were action potentials of large ganglion cells. There is now some doubt whether these structures can be considered to be typical ganglion cells of the optic nerve or whether a special function should be attributed to them. A further objection was raised by Pirenne.[5] The minimal stimulus intensity which produces a discharge of retinal spikes lies approximately three to six log units above the human threshold and presumably just as high above the sensory threshold of the investigated animals, as shown by training experiments. To this circumstance quite a different significance has to be attributed than to the already mentioned similar difference between subjective threshold and electroretinogram threshold. In contradistinction to the slow potentials of the electroretinogram, the nerve spikes comply with the "all or nothing law," so that their threshold is clearly defined and independent of the potential amplification. Thus the high threshold value supports the suspicion that the examined ganglion cells and fibers of the optic nerve, respectively, cannot be considered as typical structures.

In view of these and numerous other unsolved problems which could not be treated here in detail, there is little hope for a prompt and complete clarification of the bioelectric processes underlying the human electroretinogram. Yet clinical electroretinography may even now draw several important conclusions. By an improved stimulus technique—first of all by the use of higher intensities and colored and intermittent light stimuli—a separate examination of scotopic and photopic functions is made possible. This doubtlessly means progress in comparison to simple "standard stimulus"

mainly used up until now. However, a final conclusion regarding the value or nonvalue of the clinical electroretinogram will only be possible when the experimental conditions actually guarantee that a maximum of information can be obtained.

DR. JULES FRANÇOIS (Ghent, Belgium): I would like to add only a few remarks. For the moment the electroretinogram has clinically two main aspects. On the one hand, we have the b-wave in a range from 0.25 to 0.50 millivolt. On the other hand we have the a-wave which gives after several stimulations the same responses.

Electroretinography with monochromatic light is more interesting than with a white light stimulus. I am here in complete agreement with Dr. Henkes.

The clinical importance of electroretinography lies in diagnosing retinitis pigmentosa. In that case we find no response at all. This is an important differential diagnostic point between primary and secondary retinitis pigmentosa. It is also of great importance in Oguchi's disease.

I think that the electroretinogram originates in the layer of the rods and cones and not in the ganglion-cell layer. While we find in retinitis pigmentosa no response at all, in lesions of the optic nerve we have a normal response. Also, in occlusions of the central artery we get a response, and often a normal one. I think also that we can learn much more by the combination of electroretinogram and electroencephalogram.

DR. BEST (Bonn, Germany): I have had very little experience with electroretinography, but I have enjoyed these presentations very much. I think it is very valuable that the examinations are made not only under fixed standardized conditions, but also with systematic variations of the fixation pattern. One fact that has struck me is the problem of different responses at different stages of the same pathologic process. In some stages the responses are normal, at other stages they are subnormal, and I would like to ask a question pertaining to the explanation of these patterns. I would like to ask Dr. Henkes what the performance of all the elements of the retina are, and why they start to perform in that way.

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BACILLUS PROTEUS ENDOPHTHALMITIS*

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In 1953 Callaghan[1] reported a series of 1,653 cataract extractions in which there occurred five cases of endophthalmitis. All of these infections were thought to be caused by coliform bacilli, three of them by B. proteus.

Preoperative treatment of cataract patients with antibiotics and sulfonamides eliminates the gram-positive cocci from the lid margin, conjunctiva, and lacrimal sac in most cases. The Bacillus proteus, if present, is not inhibited by many antibiotics, and proliferates in the absence of other competing organisms.

Routine cultures in our laboratory have revealed B. proteus in the conjunctival sacs and nasal passages of many older patients. After treatment, re-infection of the conjunctiva with B. proteus frequently occurred.

Maylath and Leopold[2] have shown that the endothelium of the rabbit's iris is capable of phagocytosing pathogenic organisms. When the inoculum into the anterior chamber was small, gross infection did not occur.

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With an organism of low pathogenicity such as B. proteus, one would not expect intraocular infection to follow surgical procedures, because of the low concentration of organisms in the sac. However, Callaghan's report suggests that B. proteus may have a higher pathogenicity for the eye than previously supposed.

Experimental studies

1. Intraocular infection with B. proteus

Cowan (1953),[3] in this laboratory, studied three patients with chronic conjunctivitis, from the conjunctival sacs of whom he repeatedly cultured B. proteus. He injected each of these strains into the anterior chambers of rabbits' eyes, using 0.05 cc. of a 24-hour broth culture and produced panophthalmitis in every case. When he diluted the cultures to 10^{-2}, the panophthalmitis was less fulminating and some eyes recovered. With a dilution of 10^{-3} many eyes developed only a clouding of the cornea, and most recovered spontaneously.

2. Intraocular penetration of Gantrisin†

Using a slight modification of the method of Britton and Marshall,[4] aqueous levels of Gantrisin were determined using various methods of administration. Aqueous was obtained by puncture of the anterior chamber with a No. 27 needle while the animal was under sodium pentobarbital anesthesia. The drug was administered by the intramuscular and intravenous routes as the diethanolamine salt (40 percent), and topically into the conjunctival sac in the form of commercially available ophthalmic drops and ointment.

In Table 1 it will be seen that, three hours following a single intramuscular dose, the aqueous levels were approximately 25 percent of those in the plasma. Twenty-four hours after a single intramuscular dose the aqueous levels were approximately 50 percent of the plasma levels. Repeated injections of 0.1 gm./kg. at four-hour intervals following an initial injection of 0.2 gm./kg. did not result in any appreciable rise in aqueous level.

TABLE 1

Average plasma and aqueous levels of Gantrisin after single intramuscular injection

Dose (gm./kg.)	Time after Injection (hr.)	Plasma (mg. %)	Aqueous (mg. %)
0.10	3	6.9	1.9
0.15	3	7.8	1.6
0.20	3	9.0	2.1
0.15	24	1.4	0.8

Using the commercial ophthalmic Gantrisin ointments and solutions, it will be seen in Table 2 that average aqueous levels ranging from 0.9 to 1.3 mg. percent were obtained.

When the corneas were abraded (table 3) topical application resulted in levels which were five times higher than those with the epithelium intact.

Following subconjunctival injection of 0.25 cc. of Gantrisin solution containing 5.0 and 10 mg., aqueous levels did not exceed those following topical administration. With a dose of 20 and 40 mg., aqueous levels approximated those obtained by topical administration onto the abraded cornea. Hyaluronidase (five units per dose), added to the solution injected, gave no increase in the aqueous levels (table 4).

TABLE 2

Aqueous levels of Gantrisin after instillation of ophthalmic ointment and drops in normal eyes

Dosage in Each Eye	Time after Final Dose (hr.)	Average Aqueous Levels (mg. %)
Single dose ointment	1½	0.98
Ointment, dose repeated in two hours	1½	1.3
Single dose, three drops	1½	0.9

† Gantrisin is the Hoffman-La Roche commercial preparation of sulfisoxazole.

TABLE 3

AQUEOUS LEVELS OF GANTRISIN AFTER INSTILLATION OF OPHTHALMIC OINTMENT AND DROPS IN ABRADED EYES

Dosage in Each Eye	Time after Dose (hr.)	Average Aqueous Levels (mg. %)
Ointment	1½	4.6
Ointment	4	4.4
3 drops (single dose)	1½	3.1
3 drops (single dose)	4½	2.0
3 drops (repeated in ½ hr.)	1½	10.5
3 drops (repeated in 2 hr.)	1½	6.8

TABLE 4

AQUEOUS LEVELS OF GANTRISIN AFTER SUBCONJUNCTIVAL INJECTIONS (0.25 ml.)

Dosage (mg.)	Time after Injection (hr.)	Aqueous Levels (mg. %)	
		Without Hyaluronidase	With Hyaluronidase
5	1½		0.95–1.1
10	1½	1.7–3.5	1.3 –2.1
10	24	0.6–0.9	
20	1½	4.7–5.4	2.9 –4.8
40	1½	6.6–7.0	

3. SENSITIVITY OF STRAINS OF B. PROTEUS

Using a culture medium of B. proteus recommended by MacLeod,[6] sensitivities of 50 strains of the organism were determined by the serial dilution method to Gantrisin, tetracycline, chloramphenicol, and neomycin. It will be seen in Table 5 that 74 percent of these strains were sensitive to 0.6 mg. percent of Gantrisin, a concentration easily obtained in rabbits' eyes by all methods of administration. With tetracycline and chloramphenicol most strains were resistant to concentrations in excess of those obtained in the aqueous by the usual dosage. With neomycin, only 40 percent of strains were sensitive to concentrations of this drug obtainable in the aqueous[8] (table 5).

DISCUSSION

The results of these experiments would suggest that in the treatment of intraocular infections due to B. proteus, Gantrisin is the drug of choice, followed by neomycin. Chloramphenicol could not be expected to inhibit many strains of the organism at aqueous concentrations obtained by the usual routes of administration, and tetracycline is completely ineffective. However, the recent demonstration by Abraham and Burnett,[7] of high aqueous levels of chloramphenicol in human eyes (which were more than twice those found by us in rabbits) would indicate that this drug is also effective against B. proteus clinically, when the dosage is in the region of 3.0 gm. daily.

TABLE 5

SENSITIVITY OF 50 STRAINS OF B. PROTEUS TO SULFISOXAZOLE, TETRACYCLINE, CHLORAMPHENICOL AND NEOMYCIN

Agent Tested	Concentration of Agent Used	Sensitive Strains (percent)	Highest Aqueous Concentration Obtained
Sulfisoxazole (mg. percent)	0.1	6	10.0 mg. % (repeated drops in abraded eyes)
	0.15	22	
	0.3	66	
	0.6	74	
Tetracycline (μg./cc.)	25	4	0.7 μg./cc. (intravenous)
	50	22	
	100	80	
Neomycin μg./cc.	1.2	12	4.0 μg./cc.
	2.5	38	
	5.0	46	
	10.0	84	
Chloramphenicol μg./cc.	10	50	2.6 μg./cc.
	20	84	

While it is seldom possible to demonstrate the causative organism during the course of a postoperative panophthalmitis, one must always consider the possibility of one of the gram-negative bacilli as the etiologic agent. Because of the potential danger of Bacillus proteus, and its frequent occurrence in the conjunctival sacs of older people, Gantrisin could well be added to the therapeutic regimen in the treatment of intraocular infections.

Summary

1. Therapeutic levels of Gantrisin were obtained in the aqueous by all methods of administration.

2. Over 70 percent of strains of B. proteus were inhibited by concentrations of Gantrisin which are reached in the aqueous by the usual methods of administration.

3. Only 40 percent of strains of B. proteus were inhibited by concentrations of neomycin which were obtained in the aqueous.

4. Chloramphenicol and tetracycline did not inhibit B. proteus in concentrations which could be obtained in the aqueous by the usual methods of administration and in the usual dosage, using rabbits.

5. Eighty percent of strains of B. proteus were found sensitive to a concentration of 20 μg./cc. of chloramphenicol, a level reported possible to obtain.

University of Toronto (5).

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BACTERIOLOGY OF TRAUMATIC CORNEAL ULCERS*

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Although much work has been carried out on the bacteriology of corneal ulcers, little has been written on the relationship between the bacteriologic picture and the clinical course of the condition.

This study of traumatic ulcers of the cornea admitted to the Royal Infirmary, Edinburgh, during the years 1952 and 1953 was, therefore, undertaken to try to correlate the clinical picture with the bacteriologic findings. The ulcers were treated with either sodium sulfacetamide or terramycin to compare the relative value of one of the sulfonamides with one of the wide spectrum antibiotics. The findings arising out of this series were then analyzed in order to determine the relationship between the bacteriology, the occupation, the preadmission treatment, and the prognosis.

Clinical material and findings

This series consists of 40 cases of traumatic corneal ulcers admitted to the Royal Infirmary, Edinburgh, during the period 1952-1953. On admission all cases had a culture taken from the conjunctival sac of

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the affected side and also from the corneal ulcer. The material was inoculated directly onto culture material. The ulcers were rubbed with terramycin or sulfacetamide powder on admission, and then were given either 0.5-percent terramycin or 15-percent sodium sulfacetamide drops, three hourly. Four cases had chronic dacryocystitis: in three of these a dacryocystorhinostomy was performed within 48 hours of admission; the topical treatment continued as in the other cases. Alternate cases were treated with terramycin and sodium sulfacetamide.

No significant difference was found in the results of the two methods of treatment. The average stay in hospital of all cases treated with sulfacetamide was 14 days against 16 days for those treated with terramycin. On discharge, 10 cases in each group had 6/12 or better vision.

The pathogenic organisms which were cultured were Micrococcus pyogenes var. aureus—seven cases; Diplococcus pneumoniae—10 cases; and from one case, Alcaligenes faecalis was isolated. The average stay in hospital of those cases growing Micrococcus pyogenes var. aureus was 23 days, and of those growing Diplococcus pneumoniae, 22 days. The type of pathogenic organism was therefore not important in the clinical course of the disease.

It appeared, however, that irrespective of the drug used a significant difference was noted in the clinical course of those cases which grew pathogenic organisms either from the conjunctival sac or from the ulcer, and those which had no growth or only grew the normal commensal organisms of the conjunctiva—Micrococcus pyogenes var. albus or diphtheroid organism. The stay in hospital of those growing pathogenic organisms was more than twice as long as those without, and the visual results were worse (table 1).

An attempt was made to differentiate between these two groups in regard to the occupation of the patient and the preadmission state and treatment.

Influence of occupation

This series includes 28 underground workers and 12 nonminers. Pathogenic organisms were found in all the nonminers but in less than a quarter of the miners (six cases): while cultures from the remaining 22 miners either grew commensals or failed to grow any organisms. The four cases of dacryocystitis were divided equally between the two groups.

The clinical course in these groups showed the same trend as the whole series (table 2) although the miners with pathogenic organisms fared better than the nonminers.

Influence of preadmission treatment

Where necessary, letters were sent to the patients' general practitioners and the first-aid post at the colliery, to ascertain in detail the preadmission treatment.

Excepting the four patients who were suffering from chronic dacryocystitis and who were therefore unlikely to benefit from simple topical therapy only, 36 cases remain. In these cases it was noted that attendance at the first-aid post where sulfacetamide was instilled soon after the injury did not influence the presence or absence of pathogens, but half the patients, both miners and nonminers, who grew pathogenic organ-

TABLE 1

Influence on stay in the hospital

	Total	Stay in Hospital (days)	Vision 6/12 or Better	Vision Worse than 6/12
Those growing pathogens	18	22	7	10+1 with tobacco amblyopia
Those not growing pathogens	22	9	13	8+1 not known

TABLE 2

INFLUENCE OF OCCUPATION

	Total	Stay in Hospital (days)	Vision 6/12 or Better	Vision Worse than 6/12
Miners not growing pathogens	22	9	13	8+1 unknown
Miners growing pathogens	6	17	3	2+1 with tobacco amblyopia
Nonminers growing pathogens	12	23	4	8

TABLE 3

INFLUENCE OF PREADMISSION TREATMENT

		Topical Therapy	
	Number of Cases	Sulfacetamide at First-Aid Post	Other Drops and Lotions
Miners with pathogenic organisms	4	3	3
Miners without pathogenic organisms	22	12	1
Nonminers with pathogenic organisms	10	—	4

TABLE 5

INCIDENCE OF HYPOPYON

	Number of Cases	Days Before Admission	Number with Hypopyon
Miners without pathogens	24	4	1
Miners with pathogens	6	3	2
Nonminers with pathogens	12	4	8

isms had instilled drops other than sulfacetamide or antibiotics—usually either castor oil or boric lotion—whereas, only one miner in the group who failed to grow pathogens had instilled castor oil (table 3).

It was found that all patients without pathogenic organisms attended their own doctor and started topical therapy slightly earlier than those with pathogens (table 4). The interval of time between injury and admission was the same for miners without pathogenic organisms and nonminers, but slightly less for miners with pathogenic organisms. As would be expected, those with pathogens had the highest incidence of hypopyon (table 5).

DISCUSSION

From these results it is seen that traumatic corneal ulcers which grow pathogenic organisms are found less often in miners than in other members of the community, and this, associated with earlier initial treatment, accounts for the better prognosis of traumatic corneal ulcers in miners than in other members of the community—a fact which was pointed out by Scott (1954).

In order to extend the findings in this paper the results in 119 cases of traumatic corneal ulcer admitted to Wards 41 and 42 of the Royal Infirmary, Edinburgh, during the period 1950-1953, were analyzed and it was seen that the same trend is found (table 6).

The only other worker who has correlated

TABLE 4

TOPICAL THERAPY AT HOME

	Number of Cases	Interval Before Starting Treatment			
		Less than 2 Days	2 Days or Longer	None	Unknown
Miners without pathogens	22	10	7	1	4
Miners with pathogens	4	1	3	—	—
Nonminers with pathogens	10	3	4	2	1

TABLE 6

RESULTS IN 119 CASES OF TRAUMATIC CORNEAL ULCER

	Number of Cases	Stay in Hospital (days)	Vision 6/12 or Better	Vision Worse than 6/12	Unknown
Miners with pathogenic organisms	23	15	12	8	3
Miners without pathogenic organisms	65	10	42	18	5
Nonminers with pathogenic organisms	22	20	8	10	4
Nonminers without pathogenic organisms	9	17	5	4	—

the bacteriologic finding with the patient's occupation was Rhodes (1940). He failed to find that there was any significant difference in the cultures from the different groups of the community. But he does state that negative cultures occurred more often in injuries from coal (28 percent negative) than in injuries from stone (four percent negative).

The failure to grow pathogenic organisms either from the ulcer or from the conjunctiva may be due to two factors. Firstly, the ulcer could be due to chemical injury of a type similar to that described by Stevenson (1927). This is unlikely or it would be more closely associated with foreign bodies. Secondly, the failure of growth could be due to the fact that the infection had already been partially overcome by the initial treatment so that the remaining organisms were so few and nonvirulent that they failed to grow on culture, in spite of careful technique. This would be most likely to occur when the treatment was started early and where the inoculation of the organisms was not deep in the cornea.

In nonminers the injury is usually caused by septic material—stone off the road, a thorn, and a cat's claw were three examples in this series. In these cases, the infection is primary and the organisms are inoculated deeply into the cornea. In miners, most of the injuries occur at the coal-face. This coal is practically sterile (Rhodes, 1941) and therefore infection must be secondary.

This secondary infection may be either endogenous or exogenous. Endogenous infection may come from either the conjunctiva or from the lacrimal sac. Conjunctival infection is not likely to be severe and should respond quickly to sulfacetamide or antibiotic therapy as the body already has specific antibodies to the organism. Exogenous infection may come from many sources: the patient's handkerchief, the first-aid attendant's hands, instruments or even the tongue, and finally from the material instilled into the eye. It can be seen, therefore, that first-aid plays a vital part in the treatment and prevention of corneal ulcers, and that inefficient or septic first-aid may do more harm than good.

Further improvement in the prevention and treatment of traumatic corneal ulcers therefore depends on cleanliness in the handling of eye injuries, on the early use of sulfacetamide or antibiotics either at the first-aid post or from the patient's own general practitioner, and finally on the appreciation of the need for greater vigilance in those injuries where the infection is primary.

SUMMARY

1. There was no significant difference in the results of traumatic corneal ulcers treated topically with sulfacetamide and terramycin.

2. Traumatic corneal ulcers in miners have a better prognosis than traumatic corneal ulcers in nonminers.

3. Pathogenic organisms can be cultured

less often from corneal ulcers of miners than from corneal ulcers in nonminers. The reasons for this are discussed.

4. The importance of the preadmission treatment on the ultimate course of the ulcer is stressed.

The Royal Infirmary (3).

ACKNOWLEDGMENTS

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THROMBI IN THE CILIARY VEINS OF EYES FROM NEWBORN INFANTS*

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It is the purpose of this paper to present 10 cases of thrombi in the ciliary veins of newborn infants. As far as we are aware there is no description of this phenomenon in the literature, either as an isolated finding or in connection with other intraocular disease.

We recognized the first case in March, 1953, in the eyes of a Negro newborn child who died in December, 1952. Out of 75 pairs of eyes from infants who were stillborn or who died shortly after birth, examined in the Wilmer eye pathology laboratory from March 1, 1953, until March 1, 1954, we collected a total of eight such cases, an incidence of more than 10 percent during that year.

Prior to March 1, 1953, the lesion had not been recognized by us. We therefore reviewed all the slides from newborn and fetal eyes acquired by the Wilmer eye pathology laboratory prior to March 1, 1953. Over 200 such cases were reviewed, but only two more instances of thrombi in the ciliary veins were found in acquisitions from the years 1935 to 1953. These two had appeared between 1950 and 1953. No cases were recognized in eyes obtained prior to 1950.

PATHOLOGIC STUDY OF THE 10 CASES WITH THROMBI

A. OCULAR FINDINGS

All thrombi appear to have been fresh (figs. 1a and 1b). A rough estimation suggests they were only a few hours old. Only parts of the ciliary veins are involved, without any particular location in the ciliary body. Some are in the pars plana, others in the processes. One case shows fine retinal hemorrhages, but all nine of the other cases

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Fig. 1a (de Groot and Friedenwald). Appearance of thrombi.

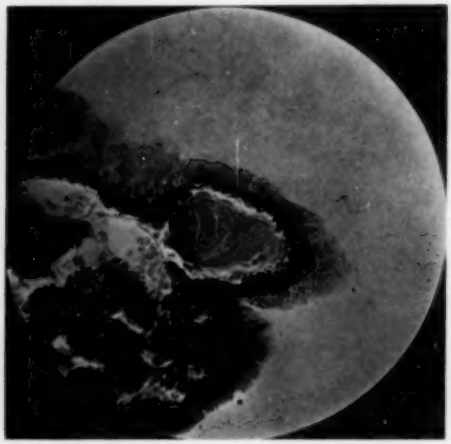

Fig. 1b (de Groot and Friedenwald). Appearance of thrombi.

show no further evidence of an intraocular pathologic process.

B. Other autopsy findings

The other organs of each infant were examined with especial attention to any generalized tendency to thrombus formation in other organs, but only three cases showed fresh thrombi in other organs. Figures 2 and 3 show thrombi in the pituitary and the adrenal.

Table 1 lists general autopsy findings of possible correlative significance.

Tables 2, 3, 4, and 5 contain data with regard to mother and infant, and clinical management of their cases, which might throw some light on the occurrence of the ciliary thrombi.

There were nine Negro infants and only one white. This is not surprising because the death ratio between Negro and white newborns in The Johns Hopkins Hospital equals approximately this ratio. The age limits varied as shown between stillborn and five days. The Rhesus factor was in all cases positive. Four of the mothers were primipara, six were multipara, and two of those had had previous abortions. Oxygen was used in all cases except the three still-

TABLE 1

Anatomic diagnosis of the newborn

Autopsy No.	Hemorrhages in other Organs	Pneumonia	Congenital Heart Disease	Septicemia	Thrombi in other Organs
22537	Yes	Yes	—	—	—
23522	Yes	—	—	—	—
24053	Yes	Yes	—	—	Liver
24210	Yes	—	—	—	Pituitary & adrenal
24539	Yes	—	Yes	Yes	Pituitary & lungs
24559	—	—	Yes	Yes	—
24569	—	—	—	—	—
24601	Yes	Yes	—	—	—
24655	Yes	—	—	—	—
24732	Yes	—	—	—	—

TABLE 2

DATA REGARDING THE INFANTS

Autopsy No.	Died	Race	Sex	Age	Pr./a T.	Birth-weight (gm.)	Delivery
22537	Aug. 1950	N	F	S.B.	a terme	3190	Spontaneous
23522	Mar. 1952	N	F	2d	premature	1030	Breech extr.
24053	Dec. 1952	N	F	3rd	a terme	2440	Low forceps
24210	Feb. 1953	N	F	S.B.	premature	1400	Cord around neck
24539	Aug. 1953	W	F	5d	premature	—	Spontaneous
24559	Aug. 1953	N	F	2d	a terme	3160	Spontaneous
24569	Aug. 1953	N	M	S.B.	a terme	5600	Caesarian Section
24601	Sept. 1953	N	F	N.B.	a terme	3600	Spontaneous
24655	Oct. 1953	N	F	N.B.	premature	1925	Fetal distress
24732	Nov. 1953	N	M	N.B.	a terme	2600	Molding of fetal head

TABLE 3

MEDICATIONS RECEIVED BY NEWBORN POSTPARTUM

Autopsy No.	Oxygen	Antibiotics	Hykinone	Digitalis	Coramine	Caffeine-Adrenalin	Paraldehyde
22537	S.B.	—	—	—	—	—	—
23522	Yes	—	—	—	—	—	—
24053	Yes	Yes	Yes	—	—	Yes	Yes
24210	S.B.	—	—	—	—	—	—
24539	Yes	Yes	—	—	—	—	—
24559	Yes	—	—	Yes	Yes	—	—
24569	S.B.	—	—	—	—	—	—
24601	Yes	—	—	Yes	—	Yes	—
24655	Yes	—	Yes	—	—	Yes	—
24732	Yes	—	Yes	—	—	Yes	—

TABLE 4

MEDICATIONS RECEIVED BY MOTHER PREPARTUM

Autopsy No.	Anesthesia	Analgesia	Antibiotics	Other
22537	Oxygen ether	—	Yes	500 cc. blood
23522	N_2O—oxygen	—	Yes	—
24053	Oxygen ether	Nembutal Demerol	—	—
24210	—	—	—	400 cc. blood, hykinone, pitocin
24539		—Not available—		
24559	—	—	—	Not known
24569	Oxygen ether	Heroine	Yes	Insulin, I.V. glucose, hykinone
24601	—	Dermerol	Yes	—
24655	—	—	—	—
24732	N_2O—oxygen	—	—	—

TABLE 5

COMPLICATIONS OF THE MOTHER

Autopsy No.	Eclampsia or Hypertension	Lues	Diabetes	Other
22537	—	Yes	—	Premature rupture of membranes
23522	—	—	—	Premature rupture of membranes
24053	Yes	Yes	—	Premature rupture of membranes
24210	—	—	—	Abruptio placentae
24539			—Not available—	
24559	—	—	—	—
24569	Yes	—	Yes	Craniopelvic disproportion
24601	Yes	Yes	—	Intra-uterine infection
24655	Yes	—	—	Abruptio placentae
24732	—	—	—	Craniopelvic disproportion

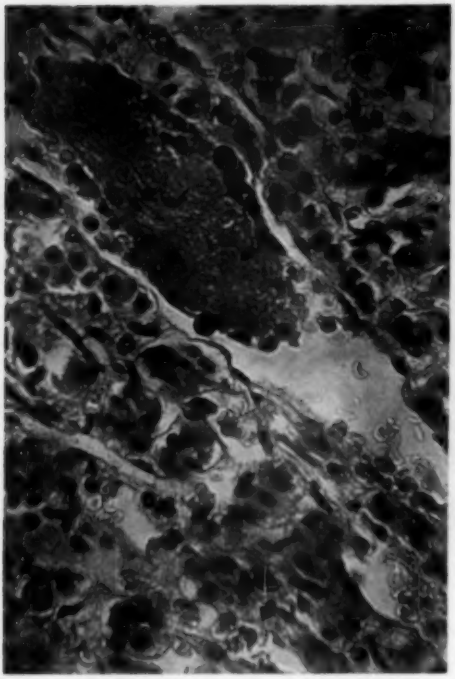

Fig. 2 (de Groot and Friedenwald).
Thrombus in the pituitary.

borns. Penicillin and streptomycin, and on two occasions gantrisin, were used as antibiotics.

All of these infants died of one or another disease resulting in anoxia. However, anoxia for years has been one of the most common causes of newborn mortality, and many newborns have died of anoxia without thrombi in their ciliary veins.

Conclusion

We can conclude from this investigation

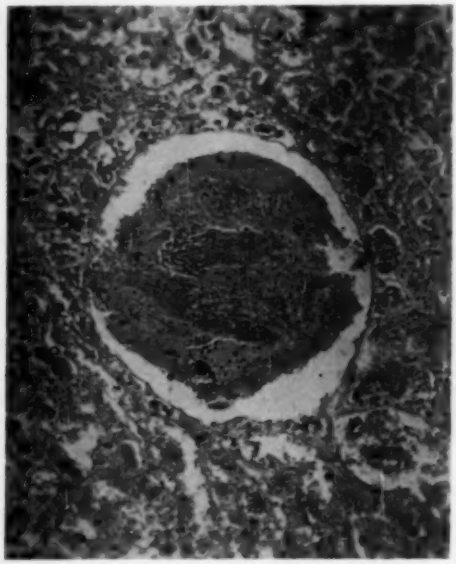

Fig. 3 (de Groot and Friedenwald).
Thrombus in the adrenal.

that thrombi in the ciliary veins of some 10 percent of newborn infants began to appear, apparently rather abruptly, in 1953. We have been unable to find an adequate explanation for this occurrence and at present it remains a mystery to us.

An interesting question that remains is what happens to such eyes in cases in which the newborn lives. In this respect, we reviewed the cases of pseudoglioma available in the Wilmer Institute eye pathology collection but we could find no evidence relating such cases to thrombi of the ciliary veins.

Henry Ford Hospital (2).

FIXATION DISPARITY IN RELATION TO HETEROPHORIA*

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The phenomenon of fixation disparity is of interest in the study of fusional processes in patients with single binocular vision. An understanding of its mechanism is of importance in the pathogenesis of strabismus. The clinical determination of the amount and type of fixation disparity relative to its practical clinical and therapeutic implications has been discussed elsewhere.[1] The present study describes a laboratory determination of the type and amount of fixation disparity existing under approximately natural visual conditions.

DEFINITIONS

Fixation disparity is a condition in which the visual axes miss exact intersection at the point of regard during normal single binocular vision.† The angular amount by which there is failure of the visual axes to intersect at the point of regard is a measure of the magnitude of fixation disparity. In the horizontal section, the fixation disparity is designated as *convergent* if the intersection occurs in front of the object of regard, and *divergent* if behind.

Single binocular vision is a more general descriptive term of a fusion status. It does not imply the presence or absence of a more critical bifoveal fusion. Verhoeff[6] suggests the term bifixation, rather than bifoveal fixation, since the latter term suggests that only the foveas are concerned in the process. Fixation disparity, therefore, is binocular fusion with inexact bifoveal fixation, the fusion being maintained by perifoveal or more peripheral areas of Panum.

PURPOSE

The purpose of this investigation was to measure the magnitude and direction of fixation disparity under experimental conditions which approximated the normal visual situation as closely as possible. Attempts were made to minimize artificial factors in the testing situation which might affect the nature of the fixation disparity.

It was also desired to determine the type of relationship existing between fixation disparity and horizontal heterophorias.

Further knowledge of sensorimotor phenomena occurring in fixation disparity may elucidate some of the problems of strabismus, since fixation disparity may be an intermediate step in the pathogenesis of strabismic states.

BACKGROUND AND HISTORY

Historically the first advance in our knowledge of fixation disparity was the realization that fusion could take place while some error existed in exact bifixation.

That single binocular vision could exist with perifoveal or more peripheral retinal areas was correctly interpreted by Lau.[7] Burian[8] and Winkleman[9] have independently conducted experiments revealing the characteristics and importance of peripheral fusion. There followed a host of clinical observations of the phenomenon of fixation disparity with targets of various configurations and sizes.

The next important step was the realization that a correlation existed between the direction of fixation disparity and the direction of heterophoria,[10] although a quantitative relationship was not found.

* From the Division of Ophthalmology, Department of Surgery, Stanford University School of Medicine. This investigation was aided by a grant from the National Council to Combat Blindness, Inc., New York, New York.

† Fixation disparity is also known in the literature as: (1) retinal slip[2]; (2) cortical slip[2]; (3) fusional disparity[4]; and (4) flicker cases.[5]

The next phase in the knowledge of this phenomenon was a variety of ingeniously designed experiments by Ogle[11,12] and coworkers who extensively investigated the possible relationships existing between fixation disparity and heterophoria. It was found that the magnitude of fixation disparity could not be predicted by the heterophoria, although it was usually in the same direction as the heterophoria.

It was found that the magnitude of normal fixation disparity, while usually in the same direction as the heterophoria, correlated poorly with the magnitude of heterophoria. The magnitude of the disparity was found to depend not alone on the magnitude of the heterophoria, but also on the fusional behavior pattern.[13-15] The results indicated that the magnitude of fixation disparity would depend in some measure on the "strength of the fusional reflex processes" and certain hypotheses were proposed with regard to the "compulsion to fusion reflex."

In the present investigation we have designed the conditions under which the fixation disparity was measured so as to eliminate the central blanked-out area in the fixation target. By so doing, and by utilizing minute foveal fusionable detail, as well as large uniform peripheral fusional stimuli, more exact bifixation could take place. It was hoped that an evaluation of the relationship between fixation disparity and horizontal heterophoria could be obtained which would be more nearly that which occurs under usual seeing conditions.

It was hypothesized (A. J.) that under these conditions the character of the relationship between fixation disparity and heterophoria would be different in esophoria and exophoria. This hypothesis was based upon differences in the character of macular suppression found in esophoria and exophoria by experiments to be described in a subsequent paper.

Physiologic basis of fixation disparity

The problem of fixation disparity is primarily concerned with the foveal areas of Panum. The relationship of physiologic nystagmus, Panum's areas, retinal rivalry, and suppression has been described elsewhere.[1] The eyes are constantly in motion when apparently steadily fixating an object of regard (physiologic nystagmus).

Within certain physiologic limits, exact and steady bifixation does not take place and the visual axes miss exact bifoveal fixation. "Thus, everyone has a minute amount of normal fixation disparity." The amount by which the axes over- or underconverge with respect to a particular object of regard is a measurement of the fixation disparity.

It appears obvious that any inherent condition, or artificially induced experimental condition, which allows more error in bifixation than might occur under normal conditions may alter the results. In order to determine the amount of fixation disparity occurring under conditions of everyday seeing, the test situation must allow for the possibility for bifixation to occur since it is the error in this situation that one wishes to measure.

It cannot be emphasized enough that the measurement of fixation disparity is a problem involving the fixing elements, namely the foveas, as well as the more peripheral areas. Adequate targets must include minute foveal fusionable detail as well as peripheral fusionable detail, the determination of the amount of fixation disparity being measured by nonfusionable dissimilar detail (such as vernier lines) any place in the visual field. The importance of target design in experiments involving fixation disparity will be discussed subsequently.

It is apparent that many factors in the testing situation may alter the fixation disparity determinations such as target design, time, fatigue, and so forth. However, as Ogle has well stated:[16] "One of the striking aspects of these data is the smallness of the quantities being measured and the precision within which they are attainable. As is the case in many other psychophysical measurements the observer feels that his judgments

are very uncertain but the actual objective accuracy proves surprisingly great."

Methodology

Variables involved in the determination of normal-occurring fixation disparity may occur in the apparatus, the technique used, and in factors inherent in the observer for that technique. A statement appears to be warranted which summarizes the factors considered in the experimental design of the present study, because of the divergent results which may occur due to the procedure employed.

The critical end-point test in these experiments for the measurement of fixation disparity was the patient's ability to align two lines (vernier), each seen monocularly. It is imperative to examine some of the factors inherent in this testing situation with respect to both the physical and physiologic variables, since this end-point is somewhat dependent upon the length of the line, separation, and whether the end-point was determined by a flash or tuning technique.

Vernier visual acuity "may be measured by the smallest recognizable relative displacement of two segments of a line. . . . Perceptually it is more complex than the threshold, showing marked field effects related to the length of the line segments and the like."[17]

Theoretically it would be ideal to have the nonfusionable vernier lines which measured the fixation disparity end-point as close together as possible and enmeshed in the minute foveal fusionable detail (print). However, if the edges of the lines are too close, indeed if they overlap, there is obviously a tendency to fuse these line segments. Even if the line segments do not overlap, nor touch, there may be some tendency to fusion and alignment by detectable ocular movements. A conflict in optimal separation therefore exists for the purposes of this experiment, inasmuch as a wider separation offers less fusion tendency, while less separation is preferred for more accuracy in measurement of the error in bifixation.

A separation of the line segments of 36 mm. (which subtended a visual angle of 21 minutes 29 seconds of arc) was chosen as the best compromise in our experiments. The projected line segments used were selected as to sharpness of borders rather than thickness which was not a relevant factor.

Tuning versus flashing

A tuning technique was chosen which allowed simultaneous perception of each line segment, and which required the subject to allow the lines to overshoot alignment at least once. He was then allowed to move the upper line back and forth as many times as necessary until he achieved satisfactory subjective alignment. This technique proved to be more sensitive and gave a more satisfactory statistical distribution of data points than a flash technique in which one of the monocularly viewed line segments was presented only momentarily. Such a flash technique required a yes-or-no or right-or-left criterion as to which side of the fellow-line segment the momentarily presented segment appeared, and was found to be a less satisfying technique than the tuning technique.

It is probable that the time involved in the determination of data points affected the determinations.[18] An optimum number of determinations for each datum point was chosen as a compromise between statistical desirability and visual fatigue. Measurements made for two subjects in this study after a four-month interval showed good repeatibility. Similar results concerning reliability were found by Shepard[19] and Ogle.[7]

Selection of patients

The 57 subjects for this investigation were medical students, hospital personnel, and private patients. All subjects had corrected visual acuity of 20/20 in each eye. All patients with strabismus, or intermittent strabismus, past or present, or with a history of visual training, were excluded from this study.

APPARATUS AND PROCEDURE

The experimental design has as its objective the binocular fusion of a large field of print with uniform peripheral as well as minute foveal fusionable detail. The determination of the error in exact bifixation (fixation disparity) was made by an end-point of optimally designed vernier acuity technique utilizing monocularly presented polarized lines at the fixation area. The target design utilized at all times allowed for the possibility of bifixation to take place, without induced visual stress conditions.

Distance fixation disparity measurements (fig. 1) were made with a field of binocularly seen printed material of uniform size print which was projected by a 200-watt projector upon an aluminized-surface curved screen of eight-foot radius. The angular subtense, at the observer's eye, of the printed material field was 15 degrees horizontally and 16 degrees vertically. The subtence of the individual letters was approximately 10 minutes of arc. Suitable adjustments were made in the over-all room illumination, the intensity of the background and of the projected vernier lines, so that alignment could be readily made against the background. The two vernier line segments, oppositely polarized, orange-colored of equal intensity, were projected on the central part of the screen, one above the other, with a separation of 22 minutes of arc. The length of each line subtended 5.7 degrees and the width subtended 1.5 minutes of arc. These lines were projected so that they were as close as possible to the centrally placed binocularly seen print. There was a narrow horizontal line between the two separated edges of the vernier lines. The vernier line segments were projected into a one-letter space between the contours of capital letters.

The lower of the two lines was stationary, while the upper was movable horizontally by virtue of its being attached to a movable microscope stage mounted on the projector. The angular extent of the movements of this line could be read on a gauge in direct contact with the movable stage. The lower line was projected by a 200 watt TDC model A-3 projector. The upper line was projected by a 750 watt Keystone overhead projector, model 1045. The brightness of the lines was equated by means of iris diaphragms and appropriate filters. The scale readings could be made to the nearest 4.4 seconds of arc.

Near fixation disparity measurements (fig. 2) were made with the design of the experiment approximating in all details that used in the distance fixation disparity determina-

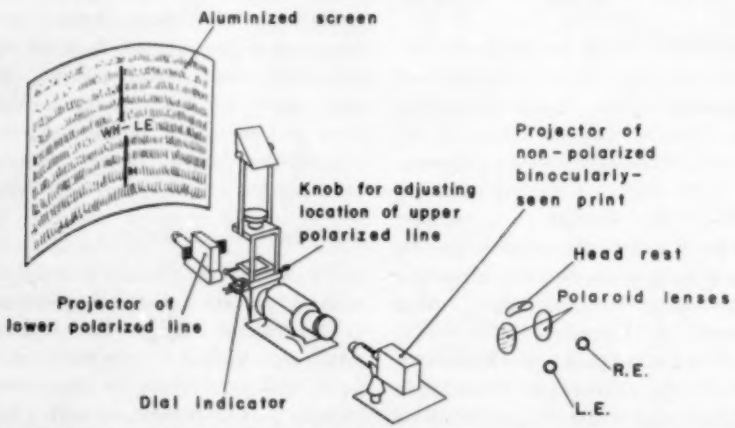

Fig. 1 (Jampolsky, Flom, and Freid). Drawing of instrumentation used for the measurement of fixation disparity with distance fixation.

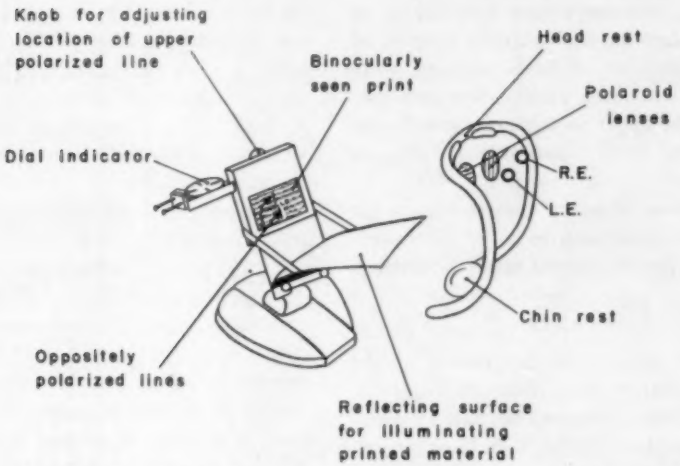

Fig. 2 (Jampolsky, Flom, and Freid). Drawing of instrumentation used for the measurement of fixation disparity for near fixation.

tions. The binocularly seen field of printed material was identical with that used at the distance, but photographically reduced. However, instead of being projected upon a screen, it was mounted in the near-point Keystone viewer which is a part of the Keystone stereomotivator apparatus. The printed material was on a transparent film, through which the oppositely polarized vernier lines were visible. The sources of illumination for the vernier lines were two 7.5-watt incandescent bulbs placed directly behind the apparatus. The printed material field was cisilluminated by an overhead lamp. The overall subtense of the printed material was 15.7 degrees horizontally and 13.7 degrees vertically. The subtense at the observer's eye of an individual letter was 12 minutes of arc.

Each vertical line was in a separate piece of film, the lower one fixed in position, the upper one attached to a movable microscope stage and gauge similar to that used for the distance measurements. Each vernier line subtended 6.5 degrees by 2.5 minutes of arc. Scale readings could be made to the nearest 6.8 seconds of arc.

Heterophoria determinations. The horizontal heterophoria for distance was measured with the observer fixing a small light source at a six-meter distance. A Maddox rod and Risley prism were placed before the nonpreferred eye. The streak was presented only momentarily, but repeatedly, and the observer's report of the relative localization was followed by necessary adjustments of the Risley prisms. The amount of heterophoria was recorded as that amount of prism which lay at the midpoint of the range of uncertainty.

The heterophoria measurements for near fixation (40 cm.) were made in a similar manner except that the subject fixated a vertical column of reduced Snellen print in order to control accommodation.

Fixation disparity determination for distance fixation. The subject was seated at a distance of 576 cm. from the aluminized screen with a phorometer set before his eyes. He was directed to fixate the horizontal line between the vernier lines. The subject directed the horizontal movement of the upper vernier line by means of an independent lighting device, and was required to use a tuning technique as described previously, until he was satisfied with the alignment. Fifteen such readings were made in which

the vernier lines were seen binocularly in order to determine the subject's concept of vertical alignment. Fifteen settings were then made with each vernier line seen monocularly, the upper movable one seen by the right eye, the lower immovable one seen by the left eye.

The fixation disparity measurements for near fixation were made in an identical manner except that the patient made the settings directly.

Results

For each subject the magnitude of the fixation disparity was obtained from the median difference between the two 15 measurement samples (that is, both lines binocularly seen, versus each polarized vernier line monocularly seen). This median difference was obtained from the graphic procedure for Wilcoxon-test confidence intervals.[20] This method yielded results which correlate highly ($R = 0.99$) with the determinations of fixation disparity by a method using the difference of the means of the two samples.

The means and standard deviations for fixation disparity and for horizontal heterophoria for the group of subjects used are shown in Table 1.

Scatter plots were constructed showing the relationship of fixation disparity and horizontal heterophoria. Figure 3 shows the scatter plot and regression curve for the distance fixation data. A similar scatter plot and regression curve for the near fixation data are shown in Figure 4. Fixation disparity is plotted on the ordinate, and the horizontal heterophoria on the abscissa. Each datum point represents an individual subject.

TABLE 1

MEANS AND STANDARD DEVIATIONS FOR FIXATION DISPARITY AND HORIZONTAL HETEROPHORIA ($N = 57$)

	Fixation Disparity (minutes of arc)		Horizontal Heterophoria (prism diopters)	
	Mean	S.D.	Mean	S.D.
Distance fixation	+1.16′	1.73′	−0.16Δ	7.4Δ
Near fixation	−0.87′	10.8′	−4.36Δ	10.9Δ

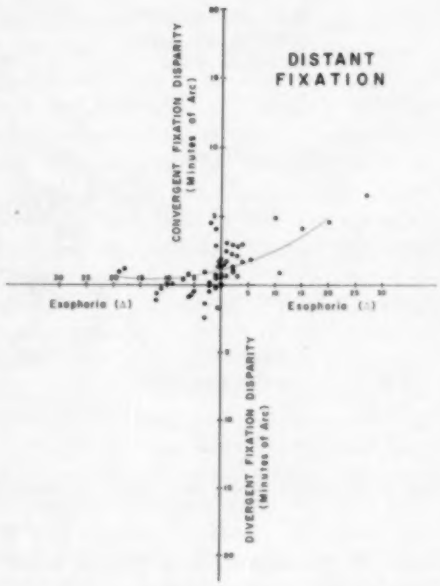

Fig. 3 (Jampolsky, Flom, and Freid). Scatter plot of data, showing relationship between heterophoria and corresponding fixation disparity with distance fixation in the present investigation.

Interpretation

It is apparent that, for distance fixation, large values of esophoria are associated with large values of convergent fixation disparity, but that for exophoria there is little or no relationship between the degree of exophoria and the fixation disparity. It appears that the relationship between fixation disparity and heterophoria is different in esophoria than in exophoria, for the limited number of subjects of this investigation.

One could have undertaken to fit two straight lines to this scatter plot of the distance data and to test whether there was a statistically significant angle between the lines. A similar, simpler approach was used by first calculating the straight line of best fit for the entire set of data. Associated with

this was an index of the goodness of the fit, $r^2 = 0.401$. The best fitting parabola was then fitted to the data. This gave a better fit ($r^2 = 0.537$) and the improvement in fit was statistically significant.

The curve shown in Figure 4 is the parabola of best fit and depicts the estimated average fixation disparity as a function of heterophoria, with distance fixation. It is apparent that the slope of the curve on the esophoria side is greater than on the exophoria side where the curve almost parallels the abscissa.

This parabola indicates that the average amount of fixation disparity is approximately the same over the range of exophoria magnitude shown. For esophores, on the other hand, it is obvious that the amount of fixation disparity increases with the increase in magnitude of the esophoria.

For the near fixation distance (fig. 4) it is apparent that the relationship between the heterophoria and fixation disparity is of the same kind for both esophoria and exophoria. Upon inspection of the data and the regression line for the near fixation data, it appears that increasing amounts of esophoria are associated with increasing amounts of convergent fixation disparity, and that similarly increasing amounts of exophoria are associated with increasing amounts of divergent fixation disparity.

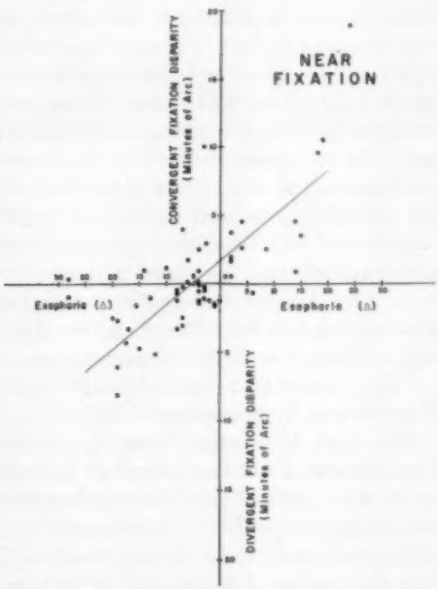

Fig. 4 (Jampolsky, Flom, and Freid). Scatter plot of data, showing relationship between heterophoria and corresponding fixation disparity with near fixation in the present investigation.

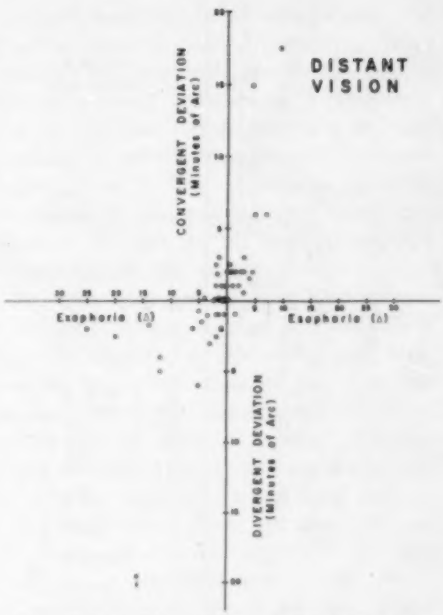

Fig. 5 (Jampolsky, Flom, and Freid). Scatter plot of Ogle's data, showing the relationship between heterophoria and the corresponding fixation disparity with distance fixation. (The co-ordinates have been changed to match those used in the present investigation.)

Discussion

Previous studies of the relationship between fixation disparity and heterophoria have shown that large amounts of fixation disparity are associated with large amounts of horizontal heterophoria. The present study seems to indicate that this relationship appears to be true for esophoria but not for exophoria, insofar as distance fixation is concerned, and is evidence in favor of our original working hypothesis (A. J.).

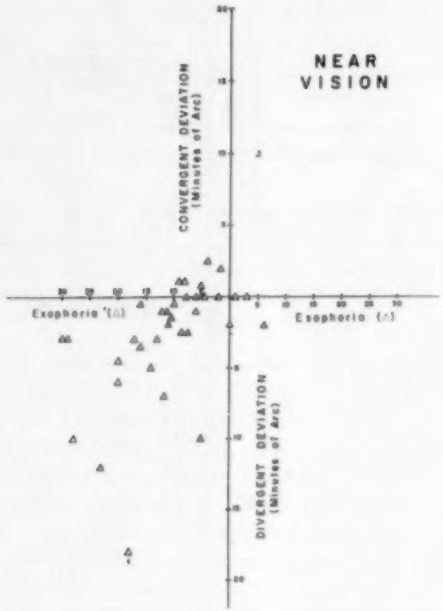

Fig. 6 (Jampolsky, Flom, and Freid). Scatter plot of Ogle's data, showing the relationship between heterophoria and the corresponding fixation disparity with near fixation. (The co-ordinates have been changed to match those used in the present investigation.)

Ogle,[14] using somewhat different techniques, also reports data on the relation between heterophoria and fixation disparity. Figure 5 depicts his data for distant vision and Figure 6 his data for near vision.

Comparison of our data in Figure 3 with Ogle's in Figure 5 shows a certain similarity of findings. In both cases the fixation disparity tends to rise more steeply with increasing degree of esophoria than it tends to drop with increasing degree of exophoria. It will be shown that the over-all range of fixation disparity is much greater in the case of Ogle's data. This may be a result of the difference in technique used, or in selection of subjects, or both.

Similarly, comparison of our data in Figure 4 with Ogle's in Figure 6 shows a certain similarity of findings. In particular the regression of fixation disparity on phoria appears to be essentially linear in both cases. Again the over-all spread of fixation disparity values is greater in the case of Ogle's data.

It may be remarked that, since the fixation disparity value for each subject in our study was based on 15 measurements with polaroid and 15 without, it was possible to construct a confidence interval for each individual's value. The technique used was that associated with the Wilcoxon (or Mann Whitney) test.[20] For distance fixation these confidence intervals (95 percent confidence) were between one and three minutes of arc in length for most subjects; at near the corresponding figures were 0.75 to 3.25 minutes of arc.

The significant difference in the magnitude of fixation disparity in the group of esophores compared with the group of exophores in the present study may in large measure be due to the technique used, especially with regard to the elimination of the central blanked-out area in target design.

Ogle was cognizant of the importance of foveal fusionable detail for the more precise measurement of fixation disparity in laboratory conditions and found that increasing the size of the blanked-out foveal area increased the magnitude of fixation disparity under the conditions imposed by the experimental situation. The extent of the blanked-out foveal area utilized in most of Ogle's experiments was 1.5 degrees, which is considerably less than previous experimenters have used. As expected, smaller amounts of fixation disparity were found and more precise interpolation of the approximation of the size of the foveal Panum's area was made (approximately six minutes of arc).

Enlarging the extent of the peripheral fusionable area will have no effect upon the error of bifixation.[19] However, elimination of foveal fusionable detail in the central area allows for greater error in bifixation to occur as a direct result of this feature of the target design.

The amount of fixation disparity is believed to be limited by the size of a foveal

Panum's area. In other words, the visual axes may err from bifixation within this area without diplopia being elicited. Artificially enlarging this area by target design allows more error in bifixation without diplopia being elicited.

More precisely, fixation disparity is limited by the size of Panum's area at the edge of the most central (foveal or axial) fusionable border. This border may be the limit of Panum's area at the fovea, the edge of a foveal or macular suppression scotoma, or an area artificially induced in the measuring technique by a blanked-out central area or absence of minute foveal fusionable detail. A type of retinal (cortical) slip may be measured by such techniques, but fixation disparity determination demands the target criteria described.

Although it is apparent that fixation disparity is a cortical concept with some degree of plasticity, it is convenient for purposes of discussion to assume it occurs in one retina. It is convenient to visualize the phenomenon of fixation disparity as if "the foveas sit on edge" or "fused by the skin of their teeth."[21]

It appears from this study that patients with exophoria may "sit on edge" within more finite bounds, regardless of the magnitude of exophoria present. Patients with esophoria, on the other hand, may have increasing errors of bifixation with increasing magnitude of esophoria, but such a correlation does not necessarily obtain.

Other factors in the fusional process may account for these differences. The difference in the relationship of fixation disparity to esophoria and exophoria may be associated with the varying amounts of foveal suppression that may be found in esophoria as compared to a relatively fixed amount of foveal suppression found in true exophoria. The relationship of suppression to fixation disparity will be analyzed subsequently.

The direction of fixation disparity was always in the same direction as the heterophoria in esophoria, but many cases of exophoria were associated with a convergent fixation disparity. Such "opposite" fixation disparity measurements are usually associated with small amounts of heterophoria, and, as Ogle has pointed out,[7] are probably artefacts of instrumentation and technique. It appears to be illogical that the direction of fixation disparity would ever occur in a direction contrary to the heterophoria for a given fixation distance.

For selected patients exhibiting esophoria at distance and exophoria at near fixation, it might be expected to find convergent fixation disparity at the distance and divergent fixation disparity for near. Seven such cases in the present study did exhibit this expected situation. These cases emphasize the fact that one may have a given set of sensorimotor conditions at one fixation distance, and an entirely different set of sensorimotor conditions at another fixation distance.[22]

Comparison of the curves for distance and near fixation distances reveal some differences in the relationship of fixation disparity to exophoria (left lower quadrant of Figures 3 and 4). For near fixation distance, increasing amounts of exophoria are associated with increasing amounts of divergent fixation disparity, while for distance fixation the amount of fixation disparity is approximately the same over the range of exophoria shown.

Fixation disparity is most likely an ocular deviation occupying an intermediate status between that of orthophoria, with bifixation, and a manifest strabismus. In this regard, the present study offers a basis for the possible differences in pathogenesis of esotropia compared with exotropia.

Summary

Fixation disparity may be defined as the amount by which the visual axes miss intersection at the point of regard during conditions of single binocular vision. Single binocular vision is a more general statement of the binocular fusional process, but does not necessarily imply the more critical bifixation

with which the problem of fixation disparity is primarily concerned.

The purpose of this study was to measure the magnitude and direction of fixation disparity under experimental conditions which approximated the normal visual situation, and to determine the type of relationship existing between fixation disparity and horizontal heterophoria.

It was hypothesized that the relationship between fixation disparity and horizontal heterophoria would differ in esophoria and in exophoria. This was supported by the evidence obtained for distance fixation. Possible reasons for the differences found are proposed, and the implications relative to strabismic and nonstrabismic states are discussed.

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For assistance with the statistical aspects of this study the authors thank Lincoln E. Moses, Ph.D., associate professor of statistics, Stanford University.

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NOTES, CASES, INSTRUMENTS

TOXIC AMBLYOPIA DUE TO QUINIDINE*

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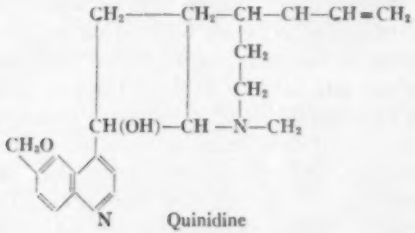
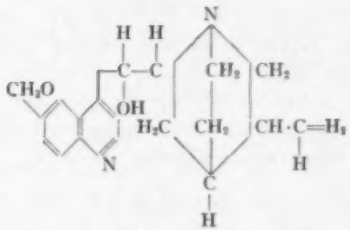
Quinidine was first introduced in certain European clinics as an antipyretic as early as 1878. It eventually became practically obsolete because of its inferiority to quinine. In 1918 Frey[1] renewed interest in quinidine by showing that of the various Cinchona alkaloids, quinidine was most effective in the treatment of auricular fibrillation. The drug was apparently not used clinically in the United States until 1922.



Quinidine



Quinine

Quinidine is a Cinchona alkaloid, the dextro-isomer of quinine. Both have a quinoline radical connected to a quinuclidine ring by a methyl alcohol link, and differ only in their spatial relation to the alcohol group.[2,3] Quinidine is a central nervous system stimulant, and acts peripherally as a general protoplasmic poison interfering with certain enzyme systems of body cells and their normal metabolic activity. The drug is not metabolized to any appreciable extent, is rapidly distributed to the tissues, and practically all of it is eliminated within a day after ingestion.

Hypersensitivity to quinidine and quinine has been given the general name of *cinchonism*. The milder manifestations such as dizziness, tremor, and tinnitus are well known. Findings of a more serious nature such as thrombocytopenic purpura,[4,5] exfoliative dermatitis,[6] and hyperthermia,[7] are less frequent. In some clinical studies dimness of vision, diplopia, and "spots before the eyes" have been mentioned, but we have been unable to find a single reported case of toxic amblyopia due to quinidine.

REPORT OF A CASE

The patient was a 60-year-old Negro who was admitted to the medical service with a provisional diagnosis of arteriosclerotic heart disease and a suspicion of myocardial infarction. Admitting examination was negative except for complaints of dyspnea, vertigo, and left chest pain. The fundus examination was negative and the patient had no visual complaints.

Serial electrocardiography showed changes compatible with auricular fibrillation and a high lateral wall myocardial infarction of recent origin. The sedimentation rate was 21 mm. (normal 0-8) with a WBC of 18,000, and RBC of 4,900,000, and a prothrombin time of 13 sec. (normal 13 sec.). The cardiolipin microflocculation was 2+ (normal-negative) and the cardiolipin complement fixation was 1+ (normal-negative).

Quinidine therapy was instituted; 3.0 gr. were given the first and second days, and this dose was increased to 12 gr. on the third day. Subsequent dosages varied from 6.0 to 15 gr. per day, dependent on clinical findings. Other medications used were aureomycin, digitalis, nitroglycerin, phenobarbital, terramycin, and thiomerin.

* From Department of Ophthalmology, Veterans Administration Hospital, Hines, Illinois.

Fig. 1 (Monninger and Platt). Central fields. Visual acuity: R.E., 20/50; L.E., 20/50. Seventeen days after beginning of quinidine.

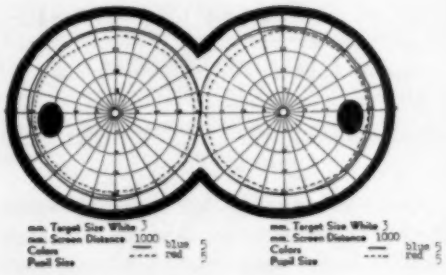


Fig. 2 (Monninger and Platt). Central fields. Visual acuity: R.E., 20/15—2; L.E., 20/15—3. Six weeks after stopping quinidine.

Seventeen days after quinidine therapy was begun, the patient complained of blurring of vision and was referred to our department. The visual acuity was correctible to 20/50 in each eye. The pupils were equal and reacted to light and accommodation. Ophthalmoscopic examination revealed an A/V ratio of 1:3, and normal discs and maculas. With a three-mm. white target at one m. visual fields showed a constriction to 15 degrees, left eye, and 17 degrees, right eye. The blue and red fields were reversed (fig. 1). A diagnosis of toxic amblyopia due to quinidine was made. The patient was placed on priscoline, nicotinic acid, and B-complex vitamins, and quinidine was discontinued.

Two weeks after this regimen visual acuity was correctible to right eye 20/30+1, and left eye 20/40−1. Visual fields showed less constriction, and the red and blue fields were about equal. The A/V ratio was 1:2 in each eye. A left temporal disc pallor was noted. At the third week visual acuity was correctible to right eye 20/25−2, left eye 20/30−2. At the sixth week the visual acuity was correctible to right eye 20/15−2, and left eye 20/15−3. Visual fields at this time were normal (fig. 2).

Comment

Walsh[3] states that in quinine amblyopia the ganglion cells are affected as a consequence of narrowing of the retinal arterioles. In our case an A/V ratio of 1:3 was noted on first examination; subsequently becoming 1:2. Visual field changes found in quinine poisoning are peripheral constriction and inversion of the red and blue fields. The same findings were present in our case when the visual acuity was 20/50 in each eye. A gradual return to normal followed discontinuance of the drug with a return of the visual acuity to 20/15− in each eye. No other medications were being used which could have caused a toxic amblyopia.

Summary

A case of toxic amblyopia caused by quinidine is presented. While on quinidine therapy the patient's vision dropped to 20/50 in each eye, and he developed a 15 to 17 degree constriction of the visual fields. These findings disappeared on discontinuing the drug.

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MULTIPLE PERIPHERAL IRIDECTOMIES*

In narrow-angle glaucoma

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Bänziger[1] introduced the operation of peripheral iridectomy for glaucoma in 1922. It has been widely used since then, especially in narrow-angle glaucoma, by Chandler,[2] O'Connor,[3] Hass and Scheie,[4] Barkan,[5] and others. It has a definite though limited place in the treatment of narrow-angle glaucoma. In certain mild cases it is effective and is the operation of choice, but the cases must be carefully selected.

Barkan[6] described a method of making three peripheral iridectomies by ab externo incisions but this operation is not in common use. In the method commonly used, a small limbus-based conjunctival flap is made and then an ab externo incision, which may be closed by a suture at the option of the operator. The iris is next grasped reasonably close to the root and a small iridectomy made.

It has seemed to me that the operation could be somewhat simplified, and, at the same time, the chance of normalizing the pressure could be enhanced, by making two iridectomies instead of one. Rather than make a conjunctival flap and an ab externo incision, the eye is fixed as for a classic limbal cataract incision and the classic incision is begun.

A Graefe knife is used, making the puncture and counter puncture at the 10- and 2-o'clock positions for the right eye (and the reverse for the left). The conjunctiva is picked up on the tip of the knife a mm. or two posterior to the point of puncture and carried upon the knife as the puncture is made. The knife is carried across the anterior chamber and the counter puncture made close to the angle, bringing the tip out under and then through the conjunctiva. A short limbal incision is made on each side just long enough to permit the iris to be grasped comfortably and withdrawn for the iridectomy. In a word, the classic limbal cataract incision is begun, but not completed (fig. 1). One iridectomy is made on each side and the iris reposited. When the instruments are withdrawn, the conjunctiva slides over both incisions and no suture is necessary. The incisions are clean and smooth and close readily. For one skilled in the use of the Graefe knife, the operation is very simply and quickly done.

Attention should be directed to the necessity for making the incisions sufficiently long to permit the manipulations required for iridectomy. If they are too short, it will be

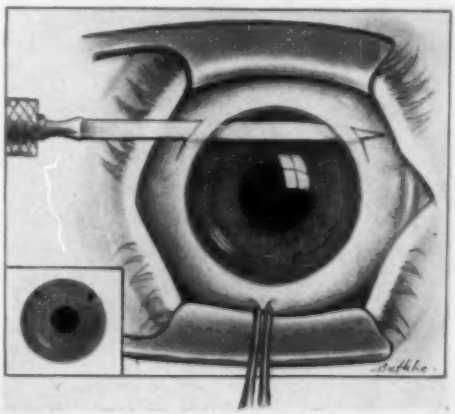

Fig. 1 (Hilding). Method of making the incisions for double peripheral iridectomies.

* From the Research Laboratory, St. Luke's Hospital. This work was supported by grants from the Louis W. and Maud Hill Family Foundation of St. Paul, the Edward C. Congdon Memorial Trust, Miss Elisabeth Congdon, and the Women's Service Guild of St. Luke's Hospital.

difficult or impossible to grasp the iris and the operation will become both troublesome and annoying.

If the iris should accidentally be punctured, it is no great calamity, because the object of the operation is to establish a communication through the iris between the anterior chamber and posterior chamber.

If the angle is entirely obliterated, as evidenced by gonioscopy, and the root of the iris in contact with the cornea, to or inside the limbus, then the incision ab externo is the technique of choice.

St. Luke's Hospital (11).

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THE IDEAL IRIS FORCEPS FOR PERIPHERAL IRIDECTOMIES

G. Bonaccolto, M.D.
New York

In cataract surgery, where the surgeon strives for a small buttonhole peripheral iridectomy (fig. 1), the size and shape of the iridectomy are often very difficult to control with the usual iris forceps. The iris forceps* I have used for the past 10 years have made small buttonhole iridectomies very easy to perform. These forceps have an over-all length of 11.75 cm. and their blades, the inside surfaces of which are slightly flattened, are sharply pointed so that, when closed, the two pointed ends meet practically at a point (fig. 2).

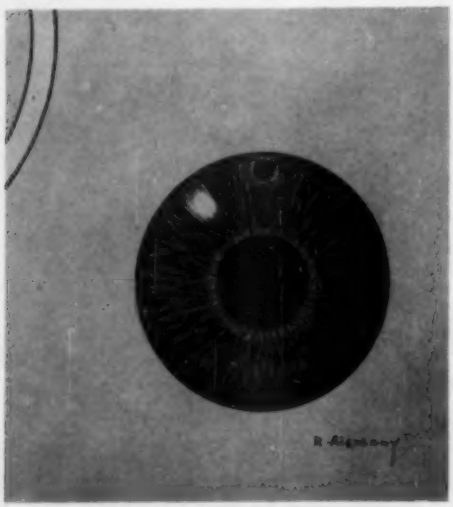

Fig. 1 (Bonaccolto). Small buttonhole iridectomy.

Fig. 2 (Bonaccolto). Iris Forceps.

The forceps are best held with the thumb and index finger applying the pressure for closure. They are applied at an angle of 45 to 50 degrees to the plane of the iris (fig. 3). To grasp the iris near its root, a small bite on the iris tissue is made from above and the iridectomy is done with iris scissors after slightly lifting the iris with the forceps

* Available at Storz Instrument Company, St. Louis, Missouri.

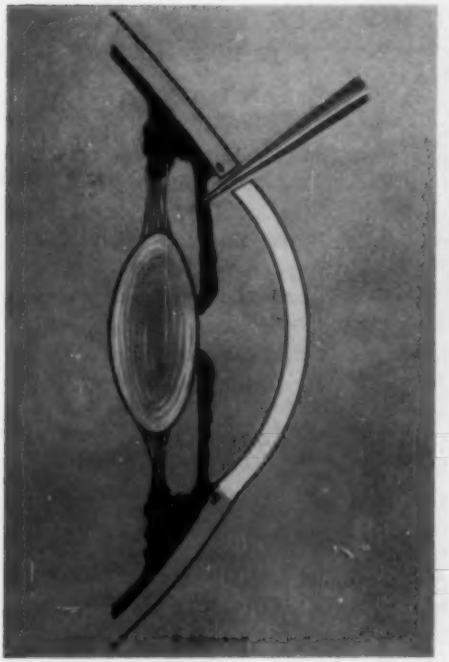

Fig. 3 (Bonaccolto). Forceps grasping anterior surface of iris.

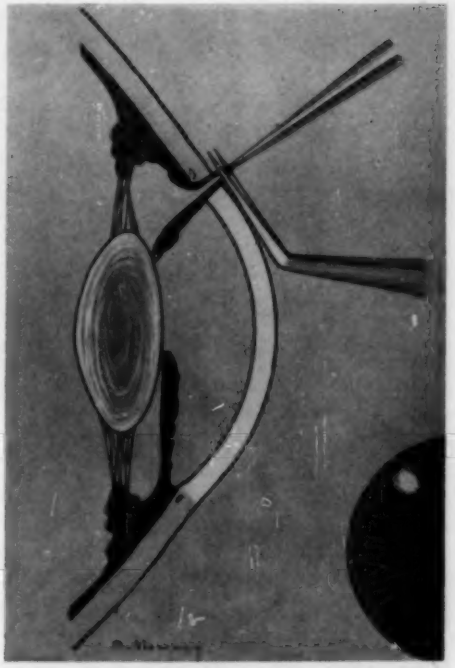

Fig. 4 (Bonaccolto). Forceps making small buttonhole iridectomy.

(fig. 4). To make a larger iridectomy, more of the iris is lifted from the blades of the iris scissors.

123 East 61st Street (21).

BOWEN'S DISEASE*

(Intra-epithelial epithelomia)

A case report

Elbyrne G. Gill, M.D., and
Ronald B. Harris, M.D.
Roanoke, Virginia

Bowen's disease is infrequently seen and represents one of the earliest cancerous changes in ocular tissue. In Bowen's original works, he described a lesion which microscopically was an intra-epithelial epithelioma of the skin. He considered this to be a precancerous dermatosis. In 1942, Mc-Gavic reported five cases of intra-epithelial epithelioma of the cornea and conjunctivas. Since his original report, only 10 cases have appeared in the literature. Reese, however, reports 18 cases at the Institute of Ophthalmology, New York. This lesion is probably not as rare as the paucity of reports indicates but, because of its insidious nature, may often go unrecognized.

Bowen's disease is an intra-epithelial epithelioma involving either the cornea, conjunctivas, or skin of the lids. In ophthalmology, it is encountered most frequently on the cornea and has the appearance of a diffuse, slightly elevated granulomatous to gelatinous-looking lesion (fig. 1). Some degree of vascularization is always present. This disease arises in the epithelium and remains confined without breaking through the basal layer of epithelium for many years. It may eventually break through the surface epithelium and, rarely, may even metasta-

* From Department of Ophthalmology, Gill Memorial Eye, Ear, and Throat Hospital.

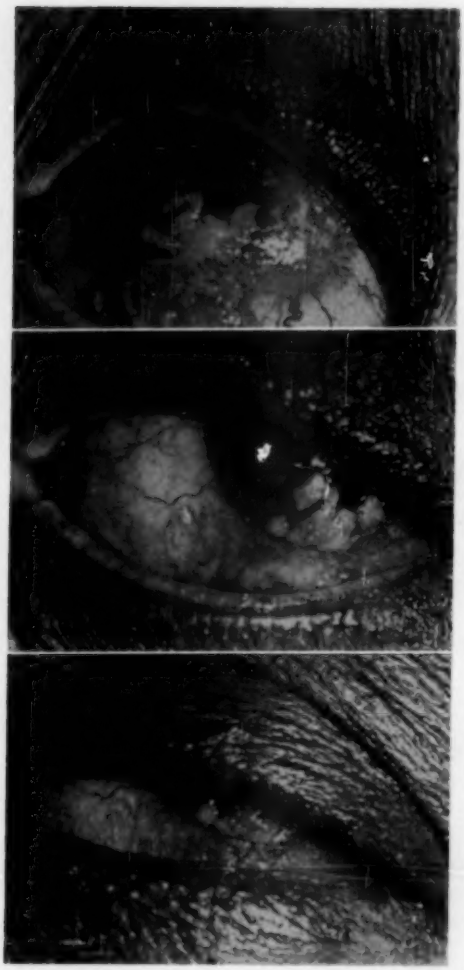

Fig. 1 (Gill and Harris). Showing the flat gelatinous growth involving the bulbar conjunctiva and cornea. The increased vascularity of the lesion may be seen.

size. The lesion is commonly associated with some type of chronic inflammation. Frequently, the epithelioma may arise in an area of chronic inflammation which may keep the neoplasm masked for some time. There is usually some degree of inflammation surrounding the growth. In McGavic's original series, three of his five cases had a preceding history of injury or inflammation. This condition is almost always limited to those in the age group of 50 years or older.

Case report

R. R., a Negress, aged 64 years, had noticed a growth on her left eye for the last two years. This had begun at the inferior margin of her cornea and had spread slowly over the surface of the cornea until it interfered with her vision. At this time, she sought medical treatment and was placed on some type of ophthalmic ointment. This did not improve the condition and she was referred to this hospital for further treatment.

A history was obtained of many years of burning, itching eyes. The patient had undergone surgery for the removal of a "tumor on her stomach," but further information concerning this was unobtainable. She also gave a familial history of a brother having had a condition similar to hers for which his eye was removed but we were unable to trace this further.

Examination. When first seen on August 16, 1955, a large gelantinous growth was present on the left eye. It involved the bulbar conjunctiva and approximately one fourth of the lower, temporal part of the cornea. A marked inflammatory reaction surrounded the lesion. The remaining cornea was thickened and edematous. Profuse lacrimation was present.

The vision in this eye was limited to light perception only, vision in the right eye, uncorrected, was 20/60. Both pupils reacted to light and accommodation. Tension in both eyes was 22 mm. Hg (Schiøtz).

The right eye exhibited thickening of the bulbar conjunctivas due to chronic inflammation but was otherwise unremarkable. The slitlamp examinations of the left eye revealed the thick gelatinous nature of the growth, as well as its marked vascularity. A tyndall effect was seen in the anterior chamber.

Cultures and smears were taken but showed only a few Staphylococcus aureus.

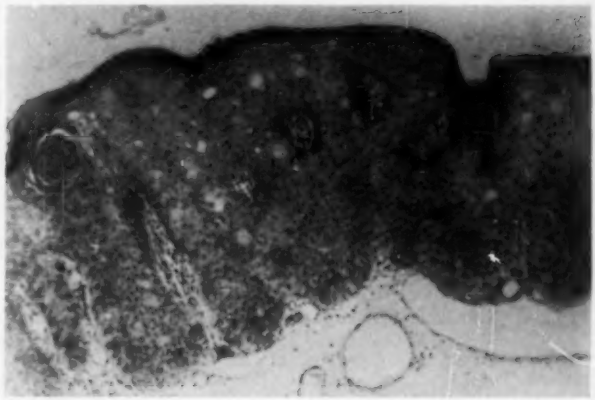

Fig. 2 (Gill and Harris). Microscopic section, showing the sudden change in the lining epithelium as it becomes increased to five times its thickness.

X-ray studies of the orbit were normal.

The remainder of the physical examination was negative. It was felt at this time that this lesion represented a neoplasm of the cornea and for this reason a wide enucleation was recommended.

Operation. The patient was hospitalized and a wide enucleation performed, removing all of the bulbar conjunctiva and some of the palpebral conjunctiva. The postoperative course was unremarkable and to date no recurrence has been noted.

The pathologic report of the tissue submitted was that of intra-epithelial epithelioma. The epithelial hyperplasia in Bowen's disease is entirely intraepithelial. In the microscopic sections in this case (fig. 2), the epithelial hyperplasia is well contained within the basal epithelium and no invasion is seen. Here the lining epithelium has suddenly become increased about five times in thickness. This abrupt transition between the normal and the hyperplastic tissue is characteristic. The cells in this layer exhibit parakeratosis, loss of polarity, hyperchromatism, and variation in size, shape, and staining reaction of the nuclei. These changes represent Darrier's porkilokarynosis, a term used to describe the cellular variation and unrest characteristic of this disease. Mitotic figures are common in this slide. The area involved was quite extensive and its origin appears to have been at the scleroconjunctival junction. The surrounding tissue shows inflammatory changes with lymphocytes, plasma cells, and histiocytes. The ciliary body shows inflammatory changes.

While this condition had been present for at least two years, no signs of invasion were present. The lesion was extensive but no penetration of the basal layer of epithelium had taken place. The exact classification of this condition is still in dispute. Some believe it to be a form of basal or squamous-cell carcinoma in situ. Others regard it as a precancerous lesion with malignant possibilities, such as seen in precancerous melanosis and, therefore, it falls into the category of Paget's disease of the breast. Certainly, from the microscopic picture in this case, it would seem that this case could be classified as a carcinoma in situ.

The treatment of choice is surgery. X-ray therapy has been used in several cases but the response is variable. Local excision seems to favor recurrence and for that reason wide excision and enucleation are advised.

While Bowen's disease has a long duration in situ, it is a potentially malignant neoplasm and should be treated as vigorously as carcinoma elsewhere in the body.

711 South Jefferson Street.

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USE OF SODIUM SACCHARINE

For testing the functioning of the lacrimal passages

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Philadelphia, Pennsylvania

This study is an attempt to evaluate the functional ability of the lacrimal passages by instilling a solution in the conjunctival sac which can be tasted after passing through the lacrimal passages and the nose into the throat. When this occurs, it is considered a positive test. If it is not tasted, the test is negative.

A solution of 10-percent sodium saccharine is used because of its easily defined sweetness, which is not unpleasant, and because of its solubility. Sodium saccharine is even soluble in a 50-percent solution with normal saline. This solution can be instilled in the eye but is somewhat irritating. A 10-percent solution is only mildly irritating and is still sweet enough to be identified. The 10-percent solution of sodium saccharine used in this series was prepared from a 50-percent solution which is commercially manufactured and used intravenously to test circulation time.

Duke-Elder[1] states, "The instillation of a coloured fluid into the conjunctival sac and the demonstration of its presence in the nose gives the best index of the physiologic permeability of the passages." He states also that the knowledge of the fact that fluids instilled in the conjunctival sac can be tasted is of considerable antiquity and is mentioned in the Hippocratic writings.

A two-percent solution of fluorescein has been used to test the patency of the lacrimal passages; however, when the fluorescein reaches the nasal passages, it is frequently necessary to use a cotton applicator to reach the solution if the nose is dry and mucus cannot be blown therefrom. Also, the fluorescein may be so diluted that a special lamp must be used to bring out its fluorescence in order to identify it.

A 10-percent argyrol solution has also been used, as has a two-percent solution of aqueous mercurochrome.

Meisling[2] added picric acid to the fluorescein so that its passage into the nose would be recognized by the taste. Rowland[3] used a solution of hydrastis which has a bitter taste, immediately detectible.

The advantage of testing by instilling a solution into the conjunctiva is that it simulates physiologic conditions; forceful irrigation with a syringe and lacrimal needle does not.

The saccharine test is not positive in every normal case. There are three percent of cases in which clinically there is no disturbance of lacrimal drainage and no tearing, and still the patient is unable to taste the saccharine. In one case, the saccharine was tasted after the patient assumed the reclining position, although it had not been tasted when the patient was supine.

When the test is positive, the saccharine is tasted in five to 17 minutes, but it may take close to an hour. Usually the taste is that of sweetness. Some patients, however, call it bitter and some patients cannot describe the taste but the sensation is always definite and the patient is sure that he tastes something different. The information is usually voluntarily given.

The taste is usually identified as coming from near the nose, as the saccharine enters the nasopharynx from the posterior nares but sometimes it is tasted as if arising in the mouth. This taste may persist for many hours and because of this usually only one saccharine test can be used in one day. In a case in which the lacrimal passages on each side must be tested on the same day, saccharine can be used on one side and a different test on the other side.

The test should not be considered negative unless at least one hour has elapsed after instillation of the drop of sodium saccharine. A false positive test may occur if the patient gets the saccharine on the fingers and tastes it there.

At present, this test is only being advocated as a qualitative, easily performed test. It is not claimed that the saccharine test is superior to any other test for patency of the lacrimal passages, but it is a simple test, not unpleasant, painless, and has no serious complications. A quantitative series is being run but the results are not yet clear because this test measures the time it takes the saccharine to pass through the lacrimal passages plus the time necessary to traverse the nasal passages to the pharynx.

The test is of special value in children old enough to identify the sweet taste. Its advantage over fluorescein is that excessive nose blowing or insertion of nasal applicators is unnecessary.

Summary

A 10-percent solution of sodium saccharine can be used as a qualitative test to examine the functional ability of the lacrimal passages. If the test is positive, it indicates that the lacrimal passages are open. A negative test does not prove the lacrimal passages are closed. The test is simple and harmless. It is of special value in children old enough to identify the sweet taste.

319 South 16th Street (2).

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ADHESION OF THE SUPERIOR OBLIQUE MUSCLE FASCIAL SHEATH

To the Medial Rectus Muscle Fascial Sheath

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Brooklyn, New York

In the discussion of anomalies of the superior oblique muscle and its fascial sheath, one must consult the works of Fink[3, 6, 7] who has, to date, given us the clearest picture of the relationships that exist between that muscle, its fascial sheath, and the eyeball. Very little is obtainable in the literature prior to the work of Fink,[3] in 1947, on the anatomic variations in the course and attachments of the oblique muscles. As he has said subsequently, in a more recent paper,[7] ". . . very little positive knowledge of anomalous formation of the vertical mechanism is available. Surgical procedures on these muscles are less frequently performed and the exposure is comparatively limited, therefore the detection of abnormal formations is more difficult. Furthermore, lack of familiarity with the complex anatomy of this region makes a comparison with the normal structure difficult."

According to Whitnall,[1] the superior oblique muscle after it leaves the trochlea ". . . bends abruptly backward, slightly down and lateralwards at a 'trochlear angle' of about 54°, and the round tendon broadens out, pierces the fascia bulbi and passes beneath the superior rectus to be inserted into the back and lateral side of the eye-

ball. The tendinous part between the trochlea and the globe is known as the reflected portion." He mentions one anomaly of the superior oblique muscle that he calls the "comes oblique superioris" but this, in reality, is an offshoot of the levator palpebrae superioris. This did not resemble the case now being reported.

Fink[3] found no true anomalies of the superior oblique muscle in his study of 100 specimens. That attests to the rarity of the condition.

Anomalies of the fascial sheath can result in anomalous check ligaments and anomalous fascial fusions. Normal fascial substance is a development embryologically, from a continuous mesodermal sheet. A failure in the proper differentiation of this sheet can result in abnormalities of the fascia that will vary in extent. The resulting anomalies may be very extensive or very slight.

A review of the literature showed that anomalies of the superior oblique varied from sheath abnormalities before, at the trochlea, and beyond the trochlea related to the enclosed muscle and its tendon.[4] Johnson[5] reported an adherence of the superior oblique muscle sheath to the sheath of the superior rectus muscle interfering with the complete function of the former and producing a paresis of that muscle. Fink[3] has extensively studied anomalies of the point of insertion as well as the fascial disturbances in the region of the superior rectus muscle. Prangen[2] has described cases where the superior oblique muscle ended in a common tendon with the medial fibers of the superior rectus muscle. In only one instance[7] was there any description of an adhesion of the fascial sheath of the superior oblique muscle to the sheath of the medial rectus muscle. In citing three cases of his Group II, Fink states, "In one instance the abnormal state involved the medial rectus and its sheath with extension of the neighboring fascia including the fascial sheath of the superior oblique tendon."

Fig. 1 (Friedman). Preoperative appearance.

Case report

C. L., a girl, aged two years (fig. 1). There was no history of ocular anomalies in either parental family. Both parents had normal visual acuity, uncorrected, and were orthophoric. Birth was normal and birth weight was 6.5 pounds.

Since birth, parents had noted that her left eye had turned inward. She preferred to hold her head downward with her "chin against her chest" and direct her gaze forward with her eyes in the elevated position. The parents thought this "cute" at first but then noted that she favored this position.

Visual acuity appeared normal with objects held at various distances. Fundi were normal and media were clear. Pupils reacted normally to light and during accommodation. With cover testing (screen comitance), the patient showed a left esotropia of 20 diopters at distant gaze (light at 20 feet) and a left esotropia of 30 diopters at near gaze (light at 10 inches). Her point of convergence was held well at 50 mm. Her master eye was her right eye. On gaze to the right, in addition to the esotropia, there was a left hyperphoria increasing from six diopters to 10 diopters as the eyes were elevated in this field (fig. 2).

Under atropine cycloplegia, she was found to have a normal reserve of hypermetropia measuring +1.5D. sph. in each eye. As a result, it was felt that the accommodative

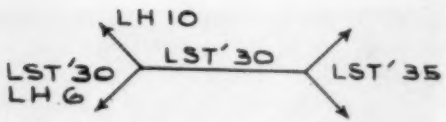

Fig. 2 (Friedman). Eye findings with cover testing.

element was negligible in this case.

Surgery was performed under general ether anesthesia. Forced ductions were performed in the four fields prior to incision. Movements were free but there was a suggestion of trochlear pull with the finger placed over the left trochlea when the eye was forcibly depressed.

Following incision of the conjunctiva and Tenon's capsule at the site of the left medial rectus tendon insertion, a muscle hook was placed to include the entire tendon of the medial rectus muscle. It was noted, however, that the upper one third of the area of the medial rectus tendon insertion was occupied by a well-formed, rounded tendon, entirely free of the tendon of the medial rectus muscle. Traction on this tendon caused movement at the trochlea and it was further noted that the former came from the area of the trochlea.

Closer inspection showed this tendon to have undergone a tucking during its developmental phase and an adhesion (fig. 3) of the fascial sheath of this muscle at the knee of the tuck had occurred, fixing it to the sclera at the upper third of the site of the medial rectus tendon insertion. This latter tendon and muscle followed an anomalous course traveling diagonally from a position inferonasally to its insertion instead of the more usual horizontal route. As a result, the tendon of the superior oblique muscle formed an acute angle with the muscle and tendon of the medial rectus.

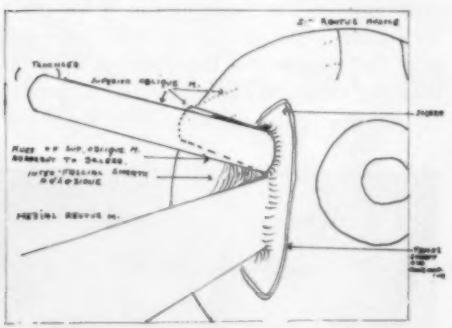

Fig. 3 (Friedman). Adhesion of the reflected portion of the superior oblique muscle tendon to the insertion of the medial rectus muscle.

With careful dissection, the adhesions were freed, the tuck opened readily, and the round tendon moved backward to resume its normal course to a position beneath the superior rectus muscle and tendon. The medial rectus muscle was recessed 4.0 mm. and the medial rectus tendon was sutured to the sclera with 4-0 plain catgut for its proper width to the new point of insertion. The conjunctiva and Tenon's capsule were closed with 4-0 plain catgut.

Comment

The literature concerning muscular and fascial anomalies of the superior oblique muscle has been reviewed. In only one instance has any mention been made of a case of adherence of the superior oblique muscle sheath to the sheath of the medial rectus muscle.[7] In the case being reported, we have an example of the restriction of action imposed on the superior oblique muscle because of adhesion of its sheath to the insertion of the medial rectus muscle. As one would expect, there was a compensatory overaction of the opposing inferior oblique muscle and as a result, the patient preferred to keep her head downward, chin on her chest, when looking straight ahead. Her primary position of gaze was with her eyes elevated.

Surgery directed toward freeing of the adhesions of the superior oblique muscle sheath as well as recession of the medial rectus muscle has resulted in a marked cosmetic improvement. She holds her head in a normal position and her primary position of gaze is normal instead of in the original elevated position. It is still too early to state

with certainty that functional orthophoria will result and fusion will be normal.

Summary

1. The literature on cases of muscular and fascial anomalies of the superior oblique muscle has been reviewed.

2. A case has been described in which there was an adhesion between the fascial sheath of the superior oblique muscle and the insertion of the medial rectus muscle tendon.

3. Surgery for the correction of this case has been described and the immediate results stated.

57 Midwood Street (25).

I wish to thank Dr. Harold W. Brown for his assistance with this paper.

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ENDOGENOUS CARTILAGE IMPLANT IN TENON'S CAPSULE

Thirty years after operation

Cecil H. Bagley, M.D.
Baltimore, Maryland

Orbital implants following enucleation of the eyeball have long been a subject of great importance to the ophthalmologist. Much research, extending over a long period of years, has been done on this particular phase of eye surgery. We all know, of course, that the prime factor in these cases is a lasting cosmetic result.

Thirty years ago, I removed a portion of the sixth costal cartilage and used it as an implant in Tenon's capsule, as reported in "Enucleation of eyeball with implantation of endogenous cartilage." The patient, at the time of operation, was a girl, aged 15 years.

Figures 1 through 4 were taken of the same patient in May, 1955, 30 years after the removal of the eye and implantation of the cartilage.

During the 30 years following the operation, the patient was seen at intervals. The condition of the stump was checked for any abnormalities that might appear in the graft. As shown in the photographs, the implanted graft has remained in the center of the orbit, thus preventing the dropping of the prothesis and the hollow appearance of the super-

Fig. 1 (Bagley). The patient 30 years after operation. The natural appearance of the enucleated eye demonstrates the good cosmetic result.

Fig. 2 (Bagley). The patient with the artificial eye removed. The graft is healthy and in place. There is no superorbital shrinkage.

Fig. 3 (Bagley). The patient with lids closed without the artificial eye. Note the natural fold of the upper lid. There is no superorbital shrinkage.

Fig. 4 (Bagley). The patient with lids closed over the artificial eye. Again note the natural folds of the upper lid.

orbital portion of the orbit. The graft has shown no shrinkage and has become a vital portion of the host.

Charles and Read Streets (2).

PERMANENT ESOTROPIA INDUCED BY CYCLOPLEGIA

A CASE REPORT

WALTER L. BAYARD, M.D.
Park Ridge, Illinois

Permanent esotropia following patching of the eye for amblyopia or disease has been reported in the literature. Temporary esotropia also has been reported following cycloplegia and patching.

Bloch* reported a case of permanent esotropia following atropine cycloplegia.* This is a report of another case of permanent esotropia following atropine cycloplegia.

CASE REPORT

D. C., aged nine years, had the history of the eyes turning in for a period of four to six hours one year previously. She had had diplopia at this time. Both diplopia and esotropia disappeared spontaneously. Her familial and developmental histories were negative. She had no subjective complaints.

There was 20/20 vision in each eye. External examination was negative. Muscle balance revealed 4$^{\Delta}$ of exophoria for near. The troposcope revealed first, second, third-grade fusion. One drop of atropine (one percent) was instilled in each eye every five minutes for three doses. One hour later the patient exhibited a 20-degree left esotropia and a homonymous diplopia. Refraction revealed a +1.25D. sph. in each eye. Fundi were negative. Pilocarpine (two percent) was instilled in each eye. The next day the esotropia was the same and screened 50$^{\Delta}$ LE +^{1} in the cardinal positions. Visual fields at this time, and two months subsequently, were normal. Pilocarpine (two percent) was used three times a day in each eye and the full cycloplegic correction was given. Intensive visual training was given for a period of six weeks. The findings were unchanged by therapy. The patient was seen at irregular intervals for the next three years, and history and findings were unchanged.

Three years after the onset of the esotropia, a bilateral resection of the lateral recti and a recession of the left medial rectus was done by another ophthalmologist. Complete neurologic examination at this time, including pneumoencephalography, was normal. Findings six weeks after surgery revealed an esophoria of 30$^{\Delta}$ for distance and 2$^{\Delta}$ for near. Binocular vision was unchanged from initial findings.

COMMENT

It is interesting to speculate why the binocular visual mechanism should be upset permanently after nine years of relatively normal function.

SUMMARY

A case of permanent esotropia following cycloplegia in a child with completely normal objective findings and binocular vision is re-

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* Bloch, G: Tr. Ophth. Soc. U. Kingdom, 49:425 (Pt. I) 1939.

ported. The only abnormality was a history of transient diplopia and esotropia one year previously.

120 Main Street.

A VERSATILE FLASHLIGHT WITHOUT BATTERIES*

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Philadelphia, Pennsylvania

Although ophthalmoscopes, retinoscopes, and other diagnostic instruments for office use can be readily obtained with adapters for attachment to the city current through a voltage reducer, this is generally not true for what is perhaps the most frequently used illuminated aid—the ordinary flashlight. The failings of the common dry-cell batteries are only too well known. And it is often when most needed that they are found to be burned out, with no replacements at hand.

The substitution of a transformer-adapting cord in the handle of a flashlight has been described in connection with a fixation light for the slitlamp microscope.[1] By incorporating an on-off toggle switch and a momentary push-button and changing to a stainless steel flexible shaft, a rather versatile instrument resulted (fig. 1). Besides the ordinary uses to which a flashlight may be put, this device has a number of additional features. The long extension is convenient for testing the ocular muscles in the extremes of rotation, or for confrontation visual fields. Changing the shape of the flexible shaft attracts the interest of young children and helps to keep their attention. Or, the physician may wrap the flexible portion around his index finger and thus have a convenient "operating lamp" for removal of foreign bodies, and so forth. To use as a fixation light on a biomicroscope, one may wind the base of the flexible part around the slitlamp framework and switch the flashlight on. In this case, the rheostat on the transformer should, of course, be turned down low, so that the filament will glow dimly.[1]

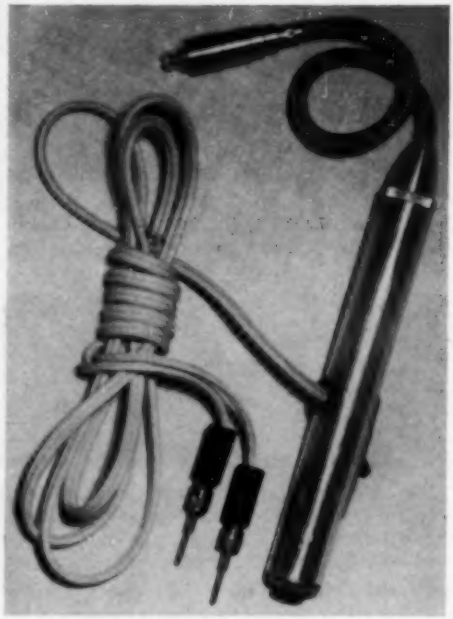

Fig. 1 (Askovitz). Flashlight without batteries.

The flexible extension can be separated from the transformer adapter and may be sterilized as desired. An ordinary flashlight bulb screws into the tip and provides the light source, or one may substitute a more expensive "shadowless" bulb. The switch on the side allows continuous use of the current; in the off position, the bulb is operated by the momentary push-button at the bottom. While these two switches are often combined, their separation leads to a sturdier mechanism and no decrease in convenience. The cord tips are green, in accordance with the usual color code for 2.5 to 3.0 volt outlet jacks.[2]

York and Tabor Roads (41).

* From the Ophthalmology Research Laboratory (Dr. I. H. Leopold, director), Albert Einstein Medical Center, Northern Division. This work was supported by a grant from the Weinstock Fund.

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SOCIETY PROCEEDINGS

Edited by Donald J. Lyle, M.D.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

October 20, 1955

Dr. Edmund B. Spaeth, *Chairman*

Ocular and palatal myoclonus

Dr. William McCarty (by invitation): The disorder known as palatal myoclonus is rather rare and the combination of both palatal and ocular myoclonus is even more rare, being ignored in the ophthalmologic literature and primarily reported in the otolaryngologic and neurologic literature. Since, as ophthalmologists, we may occasionally see such a patient, I am taking the opportunity of presenting a case this evening.

Palatal myoclonus was first described by Spencer in 1886 under the name of "palatal nystagmus." These rhythmic movements of the larynx, pharynx, and other structures have had a number of names, the original one being "nystagmus." Nystagmus by definition means only a nodding and, by long usage, nystagmus has been associated with the movement of the eyes due to a disturbance of the oculomotor mechanism. Since these myoclonic movements seem to be simple muscle twitches followed by relaxation, Riley and Brock suggested the term, "rhythmic myoclonus." Perhaps the best definition of rhythmic myoclonus may be a regular recurrent muscular contraction without opposing movements of antagonistic muscles, the rate being between 50 to 180 per minute.

These myoclonic movements involve the palate most commonly and may be synchronous with movements of other parts of the body in the following order of frequency: (1) Pharynx, (2) larynx, (3) face (including corner and floor of mouth and ala nasae), (4) eyes, (5) tongue, (6) diaphragm, (7) extremities, (8) intercostal muscles.

Once acquired the myoclonic movements continue inexorably until death and although the movements may be halted during voluntary acts such as talking and swallowing, they are said to continue unchanged during respiration, cardiac arrhythmias, and local anesthesia.

The movements of the various parts of the body have been adequately described. The palate shows rhythmic backward-and-forward and upward-and-downward movements. These movements are accompanied by simultaneous spasm of the pillars of the fauces, due to rhythmic contractions of the palato-pharyngeus and glosso-pharyngeus. There is also a shortening of the uvula brought about by the contraction of the glosso-pharyngeus.

When movements of the eyes are present, they usually appear gross, rhythmic, and jerky. They may be observed in any direction of gaze and are often synchronous with other myoclonic movements as in our case.

Case report. A. R., a 39-year-old white man, was first seen at the Wills Eye Hospital Clinic on December 4, 1950, with the complaints of "twitching of the nerve" of the right upper lid, poor speech, staggering gait, and "jumping of print before the eyes." He stated that he knew that he had multiple sclerosis and had been previously hospitalized at another hospital in this city and an Army hospital.

Past history revealed that, in 1943, he had noticed the onset of double vision, ataxic gait, speech difficulties, and intermittent dull aching frontal headaches. These symptoms continued unabated until 1945 when he had a spontaneous remission lasting one month at which time he was inducted into the Army. After two weeks of service, his symptoms returned and he was hospitalized and

received a medical discharge with a diagnosis of multiple sclerosis. Since 1946, he noted fairly constant aching pains in both feet and had transitory paresthesias of all four extremities. During the same period he had decreased libido, lack of potentia, urinary frequency, urgency, occasional incontinence, and constipation, necessitating daily enemas in order to empty his colon. Since 1948, he noted that his left eye deviated laterally and that his vision was poor.

Initial examination in the clinic of Wills Eye Hospital revealed that the patient was wearing a frosted lens before the left eye because of diplopia. Visual acuity, O.D., without correction 6/12 −1, O.S., 6/30. External ocular examination revealed a left exotropia of 15 degrees. A rotary apparent nystagmus was present, O.U., measuring 100 per minute with a 3.0 mm. excursion, O.S., and a less noticeable excursion, O.D. Pupils were equal but O.D. reacted very poorly to light and only slightly in accommodation while O.S. reacted promptly and fully.

Ophthalmoscopic examination, O.U., revealed that media were clear, the discs were well outlined and of normal color with central physiologic cups, the vessels had an AV ratio of 2:3. The maculas appeared normal with good foveal reflex.

Central and peripheral fields showed concentric contraction but were inaccurate due to myoclonic movements.

Neurologic examination on December 20, 1950, revealed a cerebellar type of speech defect with slurring and scanning of speech. Gait was unsteady and there was inability to stand on either foot along with marked swaying in the Romberg position. Rapid sustained apparent nystagmus of a rotary type was present. Pupils were equal but the right pupil reacted sluggishly to light both directly and consensually. Diplopia was elicited in lateral gaze to right and left and a weakness of superior conjugate gaze was noted. Dyssynergia and dysmetria greater on the left side were present in all four extremities. Deep reflexes were slightly more active on the right side and no pathologic plantar reflexes were elicited. Abdominal and cremasteric reflexes were present and equal. No sensory defects were elicited. It was felt that in view of the history and course of the illness, together with the signs and symptoms of involvement of the cerebellum and brain stem, the most likely diagnosis was multiple sclerosis. A skull X-ray film was taken to rule out platybasia and reported as negative except for clouding of the left antrum thought to be on the basis of extensive mucosal hypertrophy. The pineal gland was calcified and not displaced.

Laboratory data including a spinal fluid examination and Bárány test were negative.

The patient has been re-examined at regular intervals in the neurology clinic of the Wills Eye Hospital, and his condition has remained essentially unchanged. In December, 1953, involuntary movements of the palate were noted for the first time. These were not as prominent as the eye movements. The rhythmic movements of the eyes and palate were simultaneous and had a rate of approximately 100 per minute. Injection of 7.0 gr. of sodium amytal intravenously on October 12, 1955, produced a deep narcosis followed by sleep lasting approximately four hours and during this time the myoclonic movements of both eyes and palate disappeared.

Discussion. The site of pathology of rhythmic myoclonus appears to be within a triangular zone, the so-called "myoclonus triangle"—the base of which extends from the red nucleus to the homolateral inferior olive and includes the thalamodivary fasciculus (also known as the central tegmental tract); the apex corresponds to the opposite dentate nucleus and the two sides are formed by the superior cerebellar peduncle and the olivodentate or olivocerebellar fibers.

In cases with a histopathologic study the lesions were usually confined to either the central tegmental tract and the ipsilateral inferior olive or to the dentate nucleus and

the contralateral inferior olivary nucleus. With few exceptions, the inferior olivary nucleus was implicated in most of these cases and this point is stressed by Guillain. Degeneration of the central tegmental tract is apparently the cause of degeneration of the olivary body of the same side. The olive may show the same type of degeneration without involvement of the central tegmental fasciculus, but with a lesion of the opposite dentate nucleus. The olive degenerates when the cerebellum is damaged, and the greatest degeneration takes place when the dentate nucleus is destroyed. Yet, this lesion is not associated with degeneration of the central tegmental fasciculus and the destruction of the brachium conjunctivum in its course within the pons does not seem to bring about olivary degeneration.

The etiology is usually cerebral arteriosclerosis, although tumors (in the region of the corpora quadrigemina and cerebellum), multiple sclerosis, encephalitis, syphilis, and trauma have been reported. Rarely electroshock and aneurysms (vertebral artery) produce the entity.

Conclusion. 1. In conclusion, I have presented a case of a 39-year-old man with a presumptive clinical diagnosis of multiple sclerosis who developed the syndrome of a predominantly ocular myoclonus with relatively little palatal myoclonus.

2. The syndrome of palatal myoclonus has been correlated with lesions in the brain stem variously located in an area referred to as the "myoclonus triangle." The most constant site of pathology is the inferior olivary nucleus.

3. The syndrome hitherto has not been emphasized as a problem that may present itself initially to the ophthalmologist.

General discussion. DR. NATHAN SCHLEZINGER. Mr. Chairman: I think there is very little to add to the report Dr. McCarty has presented so well. I might only indicate that the neurologist is always interested in correlating the clinical syndrome with specific anatomically localized lesions, and this represents one of those clinical syndromes where the site of pathology has been worked out in terms of a relatively narrow area of the nervous system. I think that it is particularly worthy that this syndrome be brought before the ophthalmologist, because this patient was not recognized as having ocular myoclonus for a period of two or three years, and was considered to have nystagmus.

It was after continued observation that suddenly it dawned on me that there was a clocklike regularity which took it out of the category of ordinary nystagmus. At that point close inspection of the palate revealed a minimal movement of the palate synchronous with the eye movements. I am sure that movement of palate probably existed previously and had been overlooked. I think you will agree that the movie was unable to bring out that movement of the palate very clearly. It is there, but it is minimal in comparison with other cases of palatal myoclonus I have seen.

I do not believe that ocular myoclonus occurs without some evidence of palatal myoclonus. Of course it is the palate that is most commonly involved, and thereby the name of the syndrome has been considered as palatal myoclonus. Cerebral arteriosclerosis with thrombosis and multiple sclerosis represent the most common etiologic factors.

There are other points which one may speculate about with regard to this syndrome. For example, the question of somatotopic localization within the inferior olive comes to mind as a good possibility since the myoclonic movements may be limited in many instances to the palate and the pharynx, or the palate and face, or to the palate and eye muscles as in this case. This problem remains to be investigated further, perhaps on an experimental basis.

DR. I. S. TASSMAN: Some of the symptology resembles very much that which is found in the Arnold-Chiari syndrome. I would like to ask Dr. Schlezinger to differentiate the two conditions.

DR. NATHAN SCHLEZINGER: The Arnold-

Chiari syndrome, of course, affects the same general area of the brain which is involved in the syndrome of palatal myoclonus. Many other etiologic factors potentially are capable of producing the syndrome of palatal myoclonus, and a differential diagnosis requires consideration of conditions such as brain tumor, and so forth. Within the past few weeks I have observed a case of palatal myoclonus which came to necropsy, and was shown to be correlated with platybasia. Therefore, we may I think consider it possible that palatal myoclonus may occur as a consequence of the Arnold-Chiari deformity although I am unaware of any report of such a case.

DR. I. S. TASSMAN: How do you differentiate clinically between this condition and the Arnold-Chiari syndrome?

DR. NATHAN SCHLEZINGER: The Arnold-Chiari syndrome is due to a developmental anomaly, and is frequently associated with spina bifida and meningomyelocele as well as evidence of brainstem involvement. The course of illness and age of patient are aids in diagnosis. I do not believe that palatal myoclonus has been reported in childhood.

CRYOGLOBULINEMIA

DR. RICHARD A. ELLIS (by invitation) and DR. JEREMIAH KLOTZ (by invitation): The term cryoglobulinemia was first proposed in 1947 by Lerner and Watson in describing a protein or group of proteins in the blood which precipitate on exposure to cold (4°C.) and redissolve when warmed (37°C.). If cryoglobulins are present in high concentration, they may even precipitate from the serum at room temperatures. Lerner and Watson found cryoglobulins in a man who developed purpuric lesions of his extremities on exposure to cold and they suggested that the cryoglobulins precipitated in the capillaries of those areas where the temperature fell significantly below 37°C.

Cryoglobulinemia is considered to be a nonspecific indication of a disease state. It is not rare and has been found chiefly in the following variety of clinical conditions: multiple myeloma, chronic lymphatic leukemia, kala azar, malaria, rheumatoid arthritis, and subacute bacterial endocarditis. It has also been reported in cirrhosis of the liver, hepatitis, pneumonia, tuberculosis, bronchiectasis, asthma, coronary artery disease, rheumatic heart disease, chronic glomerulo-nephritis, polyarteritis nodosa, disseminated lupus erythematosus, thromboembolic pulmonary vascular sclerosis, gout, brucellosis, and gangrene of the extremities.

The test for the presence of cryoglobulinemia is relatively simple. About six to eight cc. of blood are withdrawn from the patient and kept warm. It is centrifuged for five minutes while warm and then the specimen of serum is put in the ice box at 4°C. for one week. It is important that the blood specimen is kept warm prior to centrifugation, otherwise the cryoglobulins may precipitate out with the cells. Cryoglobulins are considered to be present if the serum becomes cloudy due to the protein precipitation in the specimen when exposed to the cold. A positive test is confirmed if the cloudy serum then becomes clear when warmed to 37°C. Usually in the first 24 to 48 hours the protein will precipitate but seven days has been set as the time limit, allowing any cryoglobulins to gelify.

It is suggested that cryoglobulins, because of their unusual solubility properties, cause stasis and sludging of blood. Some authorities believe that the cryoglobulins may also infiltrate in the vessel wall.

Dilated retinal veins, retinal hemorrhages and exudates, thrombosis of smaller vessels and of the central vein have been reported in some cases of cryoglobulinemia. Less frequent eye findings reported in association with cryoglobulinemia include narrowing of retinal arterioles, silver-wire arteries, and partial occlusion of blood flow; preretinal and vitreous hemorrhages and telangiectasis on the iris surface have also been reported.

In the past year a patient with cryoglobulinemia who developed an occlusion of the central retinal artery was observed at the Veterans Administration Hospital of Philadelphia. The patient was a 33-year-old Negro who had scleroderma. He was sensitive to the cold, had gangrenous changes of his digits, and experienced a brief psychotic episode. In this case the underlying vascular defect is most likely allied to scleroderma. Involvement with this disease was demonstrable in the hands, heart, and gastro-intestinal tract. Certainly a relationship between the occurrence of cryoglobulinemia and occlusive vascular disease cannot be established; however, the cryoglobulins in this patient may possibly have contributed to the cold sensitivity, digital gangrene, retinal artery occlusion, and even the brief psychotic episode.

Because cryoglobulins may contribute to vessel obstruction, we believe that a search for these cold precipitable proteins should be made in all cases of obscure vascular occlusions.

Discussion. Dr. Sutcliffe: It might be that we can follow these patients accurately with electrophorometry tests, which I understand are easily performed. With them, it does not take a week to discover if patients have cryoglobulins in their serum.

Dr. Richard A. Ellis: As far as the ophthalmologists are concerned, I think it is much more simple merely to take the serum and place it in the ice box. I hope I did not suggest that these serums always had to be in the ice box for a week. Usually we place them in there for a few hours or a day, and the tests will become positive within the first day or two if not the first hour. So it is a relatively simple test to run, and I think that anyone can be equipped to do it. It is important, however, in running the test that the serums are kept at 37°C. prior to centrifugation because, if the blood cools, the cryoglobulins will precipitate out with the cells.

Effect of thorazine on intraocular pressure.

Dr. Satya Dev Paul (by invitation) and Dr. Irving H. Leopold evaluated the influence of Thorazine on the intraocular pressure.

Since the paper of Bierent advocated the use of chlorpromazine in cases of glaucoma, especially acute glaucoma in which he found it to be an excellent regulator of the neuro-autonomic system in its ocular circuit, it was felt that the use of chlorpromazine (Thorazine) in clinical ophthalmology needed further investigation.

In this series of experiments Thorazine was tried on 34 rabbits and 18 cats. The most effective results on the intraocular pressure were obtained by the intramuscular route. The topical applications of the drug had no hypotensive action and were irritating.

The use of 25 mg. of Thorazine had very slight effect on the intraocular pressure and no lethal action on the rabbits.

Maximum lowering of the tension, however, was obtained by the administration of 75 mg. of Thorazine. The behavior of the pupil differed in the different species of animals. In cats it was invariably mydriatic, while in rabbits the pupil was miotic. The maximum effect of the drug is at least two hours after the injection. The lowering of tension was not persistent since, on longer observation, the tension showed a tendency to rise.

The administration of 100 mg. of Thorazine had fatal results in half of the rabbits. The cats were, however, very resistant to the toxic effects of the drug. The results of the experiment with 100 mg. were similar to those obtained after administration of 75 mg. of Thorazine.

It was observed that Thorazine had a relatively better hypotensive effect on those eyes which originally had a higher tension.

The present work demonstrates that systemically administered Thorazine lowers

intraocular pressure in the experimental animal. The site of effect of this hypotensive agent was not identified in these studies.

Clinical lowering of intraocular pressure by Thorazine has been reported by Bierent in acute glaucomatous eyes and by Nutt and Wilson after employing Thorazine as a preoperative anesthetic agent.

November 17, 1955

18th Annual deSchweinitz Lecture

Observations on ocular pigment and pigmentation

Dr. Alfred Cowan (Philadelphia): The characteristics of natural pigment were considered in general, followed by a discussion of some particular aspects—normal, anomalous, and pathologic—of pigment and pigmentation of the anterior parts of the eye. Observations and conclusions were based on the slitlamp-microscopic examinations of actual cases in clinics and private practice over a period of many years.

William E. Krewson, 3rd,
Clerk.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 7, 1955

Dr. Bernard Kronenberg, *President*

Management of the dislocated lens

Dr. Charles E. Iliff (Baltimore) divided the cases into the congenital and traumatic types, and considered each from the standpoint of partial or complete dislocation. In the congenital type, other conditions may be associated, such as miosis, amblyopia, or detachment. The partially dislocated congenital lens should be removed if vision can be improved when the pupil is dilated by giving aphakic vision, if the dislocation of the lens is progressive, or if the lens is becoming cataractous. Between three and seven years of age is the time preferred for operation.

Operation is not indicated if vision is good enough to carry on in a normal classroom or job. In the case of the completely dislocated congenital lens, surgery is not done unless complications develop, such as uveitis or secondary glaucoma. In the traumatic cases, the partially dislocated lens requires immediate operation.

Lens removal can usually be accomplished with ease; it is not considered a dangerous procedure, and it averts later complications.

As for the completely dislocated traumatic lens, operation is not advisable unless uveitis or secondary glaucoma develop. Cases were followed for many years maintaining good aphakic vision without complication.

Dr. Iliff presented an excellent color film showing his method of extracting a completely dislocated lens by the use of two erisophakes. General anesthesia supplemented by local anesthesia is employed. Iridectomy is performed. An erisophake of the Floyd-Grant type with the syringe containing saline solution is introduced behind the lens and solution is injected, causing the lens to bobble up beneath the iris shelf and, at the same time, separating the vitreous from the lens. The second erisophake, of the Bell type, is used to extract the lens in the usual manner after the lens has been brought forward. Preplaced sutures are tied. Miotics are used.

Injuries of the eye

Dr. Meyer H. Riwchun said that, with the availability of corticosteroids, antibiotics, better needles, sutures, and surgical techniques, it is possible to postpone enucleation of a severely injured eye until every effort to save the eye has been exhausted. One should bear in mind that sympathetic ophthalmia is a rather rare disease. There is a so-called incubation period of two to three weeks, giving one a chance for conservative therapy. If an enucleation is imperative a second opinion is desirable.

Minor injuries and hopelessly injured eyes

were not discussed, only the category of severely injured eyes. These are classified as (1) blunt contusions, and (2) perforating intraocular injuries without retained foreign bodies and with retained foreign bodies. Case reports were illustrated by Kodachrome slides.

It was pointed out that in the Group 2 category adequate preoperative preparation be made. Sedation, antibiotic therapy, and corticosteroids are used. Whether or not a general anesthetic is employed, thorough local anesthesia, including orbicularis and retrobulbar infiltration, is indicated.

In summarizing the entire group of severe eye injuries, certain generalities may be noted:

1. Every severely injured eye should have an X-ray study to rule out a metallic or opaque foreign body. If present, it should be accurately localized and removal attempted.

2. A small localized subconjunctival hemorrhage should make one suspect a penetrating injury at the point of hemorrhage.

3. A prolapse of iris or ciliary body usually means that there is no retained foreign body.

4. Sympathetic ophthalmia is not a common disease. Its onset, when it does occur, is from two to three weeks following injury, giving one sufficient time to try conservative therapy.

5. If light perception is present, particularly in all planes, and if there is an absence of pain, an attempt should be made to save the eye. Regardless of what type implant is used with enucleation, the resulting motion is never so good and so lasting as one's own eye.

6. Conversely, if no light perception is present and the ciliary body is badly damaged and there is severe pain, plus the presence of a good remaining eye, then the time-honored therapy of enucleation is indicated.

7. If enucleation is decided upon, have another ophthalmologist confirm your opinion.

Aside from the specific local or surgical treatment, there is a common denominator of general therapy which can and should be employed:

1. A tetanus toxoid booster shot should be given or if toxoid was never administered tetanus antitoxin, 1,500 units should be given. When this is done, always do an intradermal skin sensitivity test first.

2. A wide choice of antibiotics is available. All of us have our own particular favorite. If the patient is not sensitive to penicillin or streptomycin, my choice is penicillin (400,000 units) and streptomycin (0.5 gm.) intramuscularly two hours before surgery, eight hours following surgery, and then daily until danger of infection has disappeared. In old or contaminated wounds, local subconjunctival penicillin (100,000 units) is also administered at the conclusion of surgery.

3. ACTH or Metacorten or both, the former intravenously or intramuscularly and the latter orally, is given if there is no infection present, and if an iridocyclitis is anticipated.

Discussion. Dr. Frederick H. Theodore asked about the use of the Berman localizer and also commented that there is a certain amount of danger in giving steroids to an injured eye to cut down the postoperative inflammation.

Dr. Riwchun said that the Berman localizer is a valuable adjunct to localizing intraocular foreign bodies. It is very useful, especially in large nonmagnetic foreign bodies or small magnetic foreign bodies. As far as nonmagnetic foreign bodies are concerned, the most difficult ones that I have encountered are splinters of glass or wood. At times it has been impossible to remove them with preservation of the eye. As for the use of steroids in an injured eye, these would be given whenever an iritis or iridocyclitis is anticipated or whenever there is a great deal of edema and exudate. If infection is present, one must be sure to supplement steroid therapy with antibiotics. If

a severe infection is present, I would not recommend the use of steroid therapy but would concentrate on antibiotics. Steroid therapy should not be used if a virus disease is present.

DR. FREED asked about the use of mydriatics in a case in which the anterior chamber is filled with blood.

DR. RIWCHUN replied that the only mydriatic he would use would be homatropine so that one could inspect the interior of the eye, if possible, to rule out a dislocated lens, and so forth. Homatropine could be controlled with eserine or pilocarpine, if necessary. One should not use atropine if the chamber has a great deal of blood.

DR. MAX CHAMLIN asked about the injection of air into the orbit to help localize a foreign body.

DR. RIWCHUN stated that the air should be injected into Tenon's capsule, which gives us a good outline of the globe and shows whether the foreign body is in the globe itself or outside the globe. This frequently is quite helpful in the differential diagnosis. About two cc. of air would be employed.

DR. BERNARD KRONENBERG asked about the use of Diamox in hyphemas.

DR. RIWCHUN recommended its use when the tension is elevated. If this does not help, one should resort to paracentesis and removal of the blood from the chamber.

December 5, 1955

AQUEOUS VEINS AND THEIR RELATION TO GLAUCOMA

DR. GEORGIANA DVORAK-THEOBALD (Oak Park, Illinois) delivered the ninth annual Mark J. Schoenberg Memorial Lecture, under the auspices of the New York Society for Clinical Ophthalmology and the National Society for the Prevention of Blindness.

By means of serial sections, aqueous pathways were studied in three normal eyes. The sections were studied in consecutive order; reconstructions were made by means of drawings and models. Instead of being an oval channel as pictured in text books, the canal of Schlemm is a slit in the sclera, irregular in form, and in places it divides into two to four channels.

From the anterior surface of the canal, collector channels make their way through the sclera. These are slits, lined with a single layer of endothelium, and have no other wall. These external channels anastomose freely in the depths of the sclera; they anastomose occasionally with the other three plexuses in this region. When a branch of the collector channels reaches the episcleral veins to anastomose with the episcleral vessels, it is seen clinically and is called an aqueous vein.

Openings were found between the intratrabecular spaces into the canal of Schlemm. These had been described by Sondermann. Just as the external collector channels and the scleral veins are slits in the sclera lined with a single layer of endothelium, so the inner canals are slits in the outermost layers of the trabeculae and, as such, their walls have all the tough qualities of the trabecular fibers. By means of superimposed drawings on transparent paper, it was possible to trace and reproduce the drainage system from the anterior chamber through the intratrabecular spaces, and through the inner canals of Sondermann into the canal of Schlemm.

This anatomic study shows unobstructed pathways for the outflow of aqueous from the anterior chamber to the anterior ciliary veins and the ciliary body.

Ascher and Goldmann were the first to write about aqueous veins, both in normal eyes and in eyes suffering with glaucoma. Their findings on these veins in glaucoma led to investigation of what happens to these veins in this disease. Since these pathways are simple slits in the sclera lined with endothelium, obstruction to outflow can happen in several ways. In inflammation, cells may block the passages by massing inside the vein or by gathering between the endothelium and sclera. In pseudocapsular exfoliation, the

flocculent material finds its way through the intratrabecular spaces and blocks the outflow. The sclera is a collagenous tissue and collagen hypertrophies and scleroses with age.

In cases of chronic simple glaucoma, which were examined microscopically, the lumen of the veins markedly narrowed in very early cases, and obliterated in cases of long standing. This occurred not by changes in the veins but by hypertrophy and sclerosis of the scleral fiber.

Jesse M. Levitt,
Recording Secretary.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

November 16, 1955
426th meeting

Dr. Trygve Gundersen, *presiding*

Leptothrix infection

Dr. Taylor R. Smith (Boston): The pathology conference of the afternoon was devoted primarily to the problem of leptothrix infection producing Parinaud's syndrome and its relationship to the so-called cat-scratch fever and the possible value of the "cat scratch antigen" in identifying this condition. It was pointed out also that in recent years very few cases, which clinically coincide with the previous description of leptothrix infection producing Parinaud's syndrome, have shown the typical leptothrix organisms despite the most careful preparation in staining techniques.

Safety measures in cataract surgery

Dr. George B. Corcoran (Springfield, Massachusetts) outlined the points which he considered extremely important in preventing surgical disaster both during and following intracapsular cataract extraction:

1. Practical preoperative patient evaluation, which he divided into three parts: (1) An examination form which he requested the family physician to fill in, (2) laboratory studies which were done at the hospital prior to the patient's admission, and (3) a careful evaluation of the patient's own personal history and habits. These points he considered extremely valuable in providing the best patient care.

2. The use of suggestion to obtain the best physician-patient relationship.

3. Proper preoperation medication.

4. Complete akinesia and anesthesia, for which Dr. Corcoran advocated an O'Brien akinesia together with a retrobulbar injection of 10-percent procaine containing hyaluronidase. He pointed out that, in the last 50 patients in whom he had personally made the observation to determine how well this works to produce akinesia of the globe, he had had complete immobility in 96 percent.

5. Production of a low-tension eye. This is accomplished mainly by vigorous massage of the eye for approximately five minutes after completing the retrobulbar injection.

6. Direct zonular stripping by the method which has been described in Dr. Kirby's most recent book on cataract operations.

7. Safe tight closure of the wound, using five to seven corneoscleral sutures tied tightly.

8. Early ambulation.

At the conclusion of his paper, Dr. Corcoran presented the complications which had developed in 100 consecutive patients while the patients were in the hospital. There had been two percent with vitreous loss of which only one had formed vitreous. There were between four and five percent hyphemas occurring on the first postoperative day. Wound rupture occurred twice. Flat chamber was present three times on the first postoperative day. Iris prolapse occurred in only one patient (the one with the wound rupture), and there was broken capsule with residual capsule present in six.

The discussion of the paper concerned only two points; first, what to do to prevent nausea and vomiting, in which Dr. Corcoran stated that there was no satisfactory absolute

preventative but that he was using Thorazine either intramuscularly or by rectum. The second question was regarding the use of 10-percent procaine, which Dr. Corcoran stated he uses. Dr. Corcoran readily agreed that it was not without the possibility of danger but he is sure that no matter what anesthetic agent is used, there is some disturbance of the tissue behind the eye. Although he is taking a calculated risk in using the stronger percent of procaine, he is confident that he is preventing more complications which might otherwise develop if his anesthesia were not so complete. Consequently, he is of the opinion that the risk is justified by the gain.

Intraocular foreign body

Dr. Hugh C. Donahue (Boston): After reviewing the problems of intraocular foreign bodies in general, Dr. Donahue presented a case in which a metallic foreign body had penetrated the outer coat of the eyeball, passed downward at a very obtuse angle, avoiding the lens, apparently ricocheted off of the inferior retina, and passed backward, penetrating the retina, choroid, and posterior sclera, becoming lodged upon its external surface. There resulted a small amount of anterior hemorrhage and moderate vitreous hemorrhage which persisted in the form of organized strands of proliferans which fortunately were below the macula and did not interfere greatly with vision.

Following several attempts at removal by the anterior route with a magnet, a posterior approach was made and the foreign body was found to be outside of the sclera. There had been no infection and no corneal or lens opacity developed.

In the discussion which followed, Dr. Verhoeff raised the question as to whether the foreign body had actually bounced off of the retina from the internal surface or whether it had merely been deflected by the change in density of the medium through which it was traveling, and he stated that he did not consider this a particularly unusual case.

Ocular diseases of virus etiology

Dr. Hugh L. Ormsby (Toronto) presented an excellent review of the present knowledge in the field of ocular diseases due to virus etiology, indicated the role of tissue culture methods in establishing diagnosis during the past few years, and outlined some of the problems that lie ahead. He explained at the start of his discussion that trachoma and inclusion conjunctivitis have been classed as atypical virus diseases, since both of these have been shown to be susceptible to antibiotics or sulfa drugs in vivo, and that at the present time none of the true viruses has been shown to be so susceptible.

The major part of Dr. Ormsby's discussion was centered around epidemic keratoconjunctivitis and adenoidal-pharyngeal-conjunctival (APC) viruses. He described the clinical picture of the APC infection, pointing out that, in the adult, the disease consisted usually of unilateral follicular conjunctivitis, followed in most instances by involvement of the second eye in three to five days.

The preauricular node was slightly enlarged and tender on the side of the affected eye. Pharyngitis occurred in some instances and catarrhal otitis media in others. Very rarely did adults show any fever, malaise, or muscle pains.

Corneal opacities were seen with the slit-lamp in about half of the adult patients he had seen, and they were less opaque than those usually present in epidemic keratoconjunctivitis. Most of the opacities disappeared within six weeks, very few persisted beyond six months. Vision was not seriously impaired in any case but slight blurriness occurred in the affected eye when the opacities involved the visual axis.

The clinical picture in children differed frm that in adults in that many had fever of 102°F. to 105°F.; pharyngitis was almost always present; and catarrhal otitis media was very common. Corneal opacities were uncommon in children and were found only when very carefully looked for. He pointed

out that in the children particularly, contagion definitely seemed to be centered around the use of swimming pools, although the virus had not been isolated from the water of the swimming pools. The clinical picture, however, was very variable and many patients did not show more than one or two of the group of symptoms described as occurring in this condition.

After presenting clinical data on the APC group of viruses, he then took up epidemic keratoconjunctivitis, pointing out certain differences and similarities which he has found to exist. The main difference which he called to attention was the fact that corneal opacities are much more persistent and much more intense than those which occur with the type III APC infection.

Tissue culture methods which have been used in the isolation and identification of these viruses were described, and the immunologic relationships between the various viruses under discussion were presented. Dr. Ormsby feels that the main problem remaining in this particular group is to carry out many isolations of virus from patients with follicular conjunctivitis and to establish which types of viruses are associated with corneal opacities, although he stated that it is likely that the variation in the corneal picture within each APC type will depend upon the severity of the infection and the resistance of the host more than upon the individual strain of virus.

The remainder of the paper was concerned with discussion of other forms of virus diseases, taking up vaccinia, variola, and herpes simplex of the cornea. It was pointed out that, from the results of experimental studies, it seems probable that the cornea is not protected against a variola or a vaccinial keratitis by the commonly practiced methods of vaccination, although these may modify the condition should it occur.

The final topic considered was that of herpes simplex corneae. After discussing the immunologic aspects of this condition, he called attention to the fact that steroid therapy (in the form of cortisone) has been notorious in its ill effects on this condition. He pointed out that in the treatment of dendritic keratitis in humans, the inflammatory reaction is suppressed, giving one a false sense of security, for the ulcer spreads rapidly and the stroma is invaded, resulting eventually in perforation.

Three possible mechanisms must be considered in attempting to explain these phenomena, (a) local production of antibody in the cornea may be suppressed by the hormone, (b) the virus may be enhanced in its activity, (c) the protective and reparative processes are suppressed. He pointed out that in many instances the application of cortisone to the cornea is the result of self-treatment by the patient.

In discussing other factors in herpes simplex of the cornea, it was pointed out that in a majority of dendritic ulcers, stromal reaction in the cornea also may be found, and that the early epithelial lesions are very similar to those seen in epidemic keratoconjunctivitis. The development of disciform keratitis was also discussed.

In concluding the discussion of herpes simplex, Dr. Ormsby strongly condemned any form of hormonal therapy in all phases of the disease. He pointed out that in the diagnosis of herpes simplex, tissue cultures greatly assist in establishing the diagnosis in suspected cases, and in many intances viruses were found to be present in tissue cultures when all other methods of attempt at isolation had failed. In addition he also recognized the great advantage of establishing a positive diagnosis in many instances within six to eight hours, whereas the older methods using animals required a week or more for the diagnosis to be established.

Discussion. Dr. Henry F. Allen (Boston) re-emphasized the point made by Dr. Ormsby regarding the value of careful office technique in the prevention of epidemics of both epidemic keratoconjunctivitis and the APC group of infections. He also asked Dr. Ormsby if gamma globulin has been found

to be of any use in these groups.

Dr. Verhoeff raised a question as to whether these APC group of diseases had been present many years ago and just had not been recognized, and suggested a possibility that many of these so-called strains may actually be variants of the same virus. In view of the fact that the severity of these conditions seems to have been increasing during the past 10 or 15 years, the question was raised as to how much more serious trouble we may anticipate as time goes on, and whether it seems likely that some antibiotic will be developed which will eliminate this problem entirely. The possibility of iridocyclitis being due to a virus was also brought up.

In reply to the questions presented, Dr. Ormsby stated that he was not aware of any work having been done on the benefit of gamma globulin in the APC group of patients; that there is no evidence to indicate that epidemic keratoconjunctivitis was ever seen on the American continent prior to 1941; and in his own personal experience, the APC type III infection had never been seen prior to 1951, his own personal experience going back to 1947. He had no personal impressions regarding the possibility of iridocyclitis being due to a virus.

David H. Scott,
Clerk.

YALE UNIVERSITY CLINICAL CONFERENCE

November 18 and December 9, 1955

Dr. R. M. Fasanella, *presiding*

Glaucoma case presentation

Dr. Eugene M. Blake: It would seem that everything possible to say about glaucoma has been said by now, so I had to cast about in my mind for a subject when Dr. Fasanella asked me to speak in this glaucoma symposium. It occurred to me that it might be interesting, and possibly valuable, to review the end-results of 100 cases of glaucoma which had been subjected to a filtering operation.

The cases were chosen from my office records without any predetermined concept. The cases were tabulated by name, age at first visit, diagnosis, preoperative pathology, postoperative pathology, duration of treatment, type of operation, preoperative and postoperative vision, and the tension on first examination and the final visit.

The patients were classified in decades, 20-29, 30-39, 40-49, 50-59, 60-69, 70-80 years. Two cases were in the first age group, the patients being 22 years of age and having cases of secondary glaucoma. The oldest patient was aged 79 years when first seen. The average age was 55.2 years, corresponding fairly well to what one would expect. Patients were next classified according to the type of operation. There were 13 simple iridectomies, four iris inclusion operations, three trephinations, eight enucleations, 28 cataract extractions, 14 cyclodiathermies, but these latter were followed by a filtering operation, as my experience, which was fairly large with cyclodiathermy, was not sufficiently good to justify its continued use in place of filtration. I readily confess to a preference for this operation, but I was surprised that so many cases were so treated.

Perhaps I should give a reason for my preference for the sclero-iridectomy operation. I think that a well-known French surgeon explained my feeling very well when, being asked how he liked the Lagrange operation, he replied, "I think that it is a very nice way to do a trephining operation."

Actually each operation removes a bit of the sclera or corneoscleral junction, plus an iridectomy, either full or peripheral. My preference for sclero-iridectomy is based on the fact that the incision can be made ab externo and as wide as one wishes. In this way it is easy to remove as much or as little of the iris as is desired. The removal of iris through a 1.5 mm. trephine opening frequently requires entering the anterior chamber which is already flat after the eyeball is

opened. A sudden penetration of the corneosclera by the trephine has been known (and more than once) to nick the lens, with resulting cataract. Hence, my loyalty to the Lagrange procedure.

Finally, there were 92 instances of sclero-iridectomy. You will note that these figures do not add up to 100, since many patients had more than one procedure, such as cataracts before or after glaucoma surgery, and so forth, and also both eyes were done, in many instances, sometimes acute glaucoma in each eye, later, bilateral cataract extraction.

The types of glaucoma were classified as chronic simple, 66; absolute, four; secondary, 28. Undoubtedly many of the so-called primary cases were actually secondary. The acute congestive cases numbered 12.

The period of observation was one month in two cases, 46 years in one patient, and an average of 8.76 years. The visual results showed 28 instances in which the vision was the same at the beginning and the end of treatment; in 29 the sight was better at the end than at the beginning of treatment; and 46 suffered a loss of vision. This latter is not surprising nor altogether an evidence of poor surgery, since many of these patients were past middle age when first examined and continued under treatment for a number of years, hence cataract formation could not be attributed solely to the surgery. Some undoubtedly had less vision immediately after the operation than before.

Discussion. DR. FASANELLA: About the cyclodiathermy operations: were they done as a last resort or as an early operation?

DR. BLAKE: Most of these cyclodiathermies were done early.

DR. FASANELLA: In the sclero-iridectomy operation do you do a scratch incision or a keratome and have you been bothered by postoperative iritis and, if so, what has been your treatment for it?

DR. BLAKE: I like a scratch incision all the way in. In regard to postoperative iritis, I do not hesitate to use atropine postoperatively where there is a filtering scar.

DR. FASANELLA: How often do you get flat chambers postoperatively?

DR. BLAKE: I don't remember any. I usually take a running suture and draw it up tight. Often the anterior chamber is established at the end of the operation.

DR. LOVEKIN: Did you get any bad eyes as a result of cyclodiathermy?

DR. BLAKE: I had two retinal detachments as complications. I do not think the cyclodiathermy is a radical operation but I think it is, perhaps, better when the diathermy applications are made closer to the limbus.

DR. CLARKE: When would you do a cataract extraction as a primary procedure in glaucoma and would you combine it with an iridectomy?

DR. BLAKE: With a swollen lens I would do a cataract extraction, trying an intracapsular extraction and I would do an iridectomy with it.

DR. FREEMAN: In a patient with a mild field loss, aged 75 years, tension normal, what is your viewpoint?

DR. BLAKE: If the loss has progressed to half a field, in such a case, I would probably operate.

DR. WIES: I have never been convinced that operation is indicated if there is a field loss with a normal tension for 24 hours a day.

DR. GLASS: Considering the early patient with a tension of between 30 and 35 mm. Hg but no field loss, would you operate?

DR. BLAKE: I probably would watch this patient for a while. It depends upon the age, general condition, and several other factors.

DR. WILLIAMS: Does massage of the globe help?

DR. BLAKE: Yes, I think it is very important after a filtering operation and I have the patients continue gentle massage two or three times a day.

DR. FASANELLA: What is your operation of choice in aniridia with glaucoma?

DR. BLAKE: Possibly cyclodiathermy.

DR. VAN LONKHUYSEN: Do you do re-

peated cyclodiathermy as an office procedure?

DR. BLAKE: Yes, I have no objection to that.

DR. KAPLAN: In secondary glaucoma in aphakia, do you use cyclodialysis? And how do you control the frequent hemorrhages occurring at operation?

DR. BLAKE: It is well to give vitamin K before operating. You can't help some bleeding. If there is a lot, you should do a paracentesis and irrigate it out.

DR. FREEMAN: I was brought up on the trephining operation but I don't use it now. I believe I saw more complications with that operation and now prefer iridencleisis. A trephination seems to be, to me, more traumatic than a sclerectomy. I don't see why but it seems to be. Usually postoperatively I use no drops.

DR. BLAKE: One important thing in an iridencleisis operation is to be sure there is no inflammation of the uveal tract beforehand.

DR. GUIDA: The procedure I have been using lately is a cyclodialysis with a portion of the iris included in the cyclodialysis space. I have had some patients under control after this operation for six to seven years. There have been a few bad results where the iris inclusion has become sealed down. One advantage is that if a cataract develops postoperatively, extraction is easily done after this procedure. Control of bleeding is helped by light cautery of the sclera.

DR. CLARKE: With iridencleisis, if you use a single pillar done nasally, this leaves plenty of room for a cataract extraction postoperatively on the temporal side.

DR. WIES: If the iris is mobile a trephination seems to be alright. If it is a long-standing case, with a nonelastic iris, I do not think a trephination should be done.

DR. BLAKE: It may help to use atropine a few hours preoperatively to minimize the resistance of the iris to stretch.

DR. CLARKE: I believe the pressure that has to be exerted in using a trephine plus the difficulty in getting adequate asepsis in a closed-tube trephine may help to increase the reaction after this type of operation.

STRABISMUS SYMPOSIUM

DR. ANDREW WONG discussed the condition known as intermittent exotropia. He referred to the work of several investigators, notably Schlossman and Scobee. He pointed out that, according to Schlossman's study, 22.6 percent of 1,431 patients with strabismus had exotropia, 77.4 percent had esotropia. In the exotropic group the classification has been difficult, but these were divided by Schlossman into three groups: the intermittent group, which included 85 percent of the patients; those with constant alternation, which included 5.7 percent; and those who had constant uniocular fixation, which included 9.3 percent. In regard to the etiology of intermittent exotropia, Dr. Wong noted the six factors that seemed to be chiefly concerned: (1) The innervational; (2) the accommodative; (3) the mechanical factor, including abnormalities of check ligaments, intermuscular membrane, and footplates; (4) the functional factor and the two accessory factors: (5) the sensory, and (6) the motor obstacles to fusion.

Dr. Wong also noted the recent work in which electromyographic tracings of patients with intermittent exotropia seem to indicate an active divergence process. In regard to the accommodative factor, he noted that statistically 31 percent of the group of patients with intermittent exotropia had 0.5 to 1.5 diopters of hyperopia; 22 percent of the group were myopic and of this myopic percentage one fourth of them were improved by refraction. The treatment of divergence strabismus was briefly summarized and the following factors were included:

(1) Correction of refractive errors if necessary, (2) abolition of suppression or amblyopia, (3) correction of abnormal correspondence, (4) training of fusion and stereopsis preoperatively (the value of this has been given different degrees of im-

portance by different investigators), (5) operative treatment, (6) further fusional treatment.

Dr. Wong mentioned that Scobee's approximate rule was that if the deviation in intermittent exotropia were over 18 to 20 prism diopters, general surgical treatment would be necessary.

Dr. F. Williams then presented a discussion of accommodative esotropia, presenting two brief case reports.

The first case was that of a 15-year-old patient originally with relative amblyopia of slight degree in one eye, an ST 8, LH2, ST′ 20, LH2 with paramacular suppression on the right eye. This was treated with refractive correction including bifocal lenses, home exercises with antisuppression, and amplitude training. Upon the completion of treatment the vision in the right eye had improved to 20/20 with correction. The measurements had resulted in an ST 2, ST′ 2 with a reduced area of suppression.

The second brief case report was that of a nine-year-old child who originally had esotropia with onset at two years of age and on the first examination here showed a vision in both eyes of 20/40 and ST and ST′ 50 plus prism diopters with no stereopsis. The treatment procedure included a recession and resection on the right eye in 1950 followed by orthoptic exercises and a recession and resection on the left eye in 1953 again followed by orthoptic exercises. The resulting status showed a vision in both eyes of 20/20 with correction, an orthophoria to ST 3 and ST′ 3 to four prism diopters, and the patient had stereopsis.

Dr. Williams then discussed several aspects of the treatment of esotropia. He mentioned the work that had been done using DFP in the early age group. Initially, 0.025-percent DFP was used, the patient being given one drop daily. This was found to be especially useful in cases with orthophoria for distance and S′ or/and ST′ for near. It seemed to reduce the variability of the angle of squint. In general, after using the drops for a month, the concentration would be cut in half for an additional month then further diluted until the age of 18 months was reached. Then a full cycloplegic correction would be used. If a patient were first seen at the age of four years, the full cycloplegic correction would be given immediately. Surgical treatment would be aimed to correct only the deviation with correction. If the patient were first seen at age seven, full cycloplegic correction would again be given and orthoptics when indicated. Dr. Williams also noted that DFP can be used to wean patients from glasses if the refractive correction were a +3.0D. or less. Again 0.025-percent of DFP was used with gradual tapering off on the concentration.

Discussion: Dr. C. Clarke: Dr. Clarke noted that the broad objective in the strabismus clinic was to get good vision bilaterally and assist in developing good fusion. The mechanisms available are refractive correction, correction of deviation of the eyes, and also the inculcation of certain psychologic concepts in the patient. In many cases one had to settle for less than 100 percent results. He felt, however, that one should not usually settle for less than good vision in each eye if at all possible. Likewise, he felt cosmetic treatment was genuinely important. In regard to exotropia he noted that lower degrees of this condition are less cosmetically deforming than similar degrees of esotropia. The evaluation of the fusion status often determines the need for surgery. If fusion is impossible, there is less of an indication for surgical treatment in small degrees of exotropia.

Large amounts of esotropia and exotropia are both bad cosmetically and would require surgery. He briefly discussed the concept of bilateral simultaneous symmetrical surgery. This approach avoids incomitance, but he noted that one disadvantage was that you cannot as easily predict the results of a given amount of surgery. In exotropia it usually takes more surgery than one would

expect from the amount of the deviation. In intermittent exotropia where there is normal retinal correspondence, surgery is often indicated even in smaller degrees of the strabismus. If the condition is allowed to persist, fusion generally becomes weakened. He discussed the complicating vertical deviations that may occur. Here again the better the chances are for fusion the more it is justified to do surgery for smaller degrees of deviation. In accommodative esotropia if you cannot produce a phoria for both far and near by orthoptics, surgery is usually necessary.

DR. LITTLE: In general, what do you hope to accomplish by the use of DFP?

DR. WILLIAMS: I feel that it is more of a holding procedure in the very early age group rather than a definitive form of treatment. It increases the ciliary tone and decreases the effort required for accommodation.

DR. VAN LONKHUYSEN: You don't use DFP with glasses, do you?

DR. WILLIAMS: No.

DR. TAYLOR: How do you feel about very early surgery on cases seen at age six months to one year with small degrees of refractive errors?

DR. CLARKE: I believe the ages of zero to two or zero to four is the age of development when the eyes are adapted to their environment and our treatment is designed to help them adapt. I believe the effect of DFP is very variable. The age period from four to six or seven is one in which orthoptics is not usually available. At the age of seven years one can usually use teaching, as well as other processes, mechanical and optical. In a case of strabismus fixus, operation should be done as early as possible. When indications are clear cut, I don't believe there is any further use in waiting for operation.

DR. GLASS: In regard to Dr. Taylor's question, I personally hesitate to operate on the ordinary case of esotropia at the age of one year. For one thing, except for the status of fixation and the objective refractive measurements, we know very little about the vision of the child's eye. Secondly, at that time ordinarily one has not had the opportunity of watching the patient long enough to determine what the natural course of development in that particular child would be. I feel there must be a reasonable number of cases in which large amounts of surgery seem to be necessary at the age of one year, but that by the age of two years or thereabouts smaller degrees of surgery would be necessary to accomplish the desired purpose. If one attempted complete correction of the surgery at the one year level, I can see the possibility of postoperative divergence developing in a considerable number.

DR. CLARKE: If you reduce the angle of deviation by surgery, further refraction and spontaneous processes may help to give them fusion. I should try to do an operation which would put the deviation within the normal level of developmental possibilities for fusion. Actually, however, surgery under the age of two is not done very often purely because of the time lapse between the original visit and the period taken for preliminary visits and examination.

William I. Glass,
Recording Secretary.

AMERICAN JOURNAL OF OPHTHALMOLOGY

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SURGICAL CERTIFICATION

For many years one of the major problems of the American Board of Ophthalmology has been the role of the ophthalmic surgery in the examination for certification of the ophthalmologist. There have been many outstanding ophthalmologists who did little or no surgery. In many instances these men had little surgical experience during their training. The present certificate indicates that the diplomate is familiar with the principles of surgery but gives no indication of his surgical ability.

The necessity of some method of determining those qualified for surgery became apparent during the war when it was assumed that certification by the board indicated surgical competency. Some certified ophthalmologists were placed in position of grave surgical responsibility only to have it

develop that they were not capable surgeons. This necessitated embarrassing changes in some instances. In addition, it seems advisable that there be some form of directory or some method of knowing whether or not a given ophthalmologist is a competent surgeon.

From time to time it has been suggested that the present examination for certification be altered in some manner so that every diplomate would have given evidence of being a competent surgeon before he was eligible for certification. However, a review of all surgical lists submitted by all candidates over a two-year period showed that this is not possible.

This review revealed that 20 percent had done less than 10 cataract operations; 20 percent had done less than five glaucoma operations; 21 percent had done less than five muscle operations. From this review of surgical lists, it seems self-evident that it would be most unfair to refuse certification to an otherwise well-trained and competent ophthalmologist because he did not qualify as an ophthalmic surgeon. While these men failed to show evidence of adequate surgical training and experience, they were otherwise competent ophthalmologists as evidenced by the fact that they passed their examination in most instances. While it is realized that at present some of these very inadequately surgically trained men will do surgery, the eventual establishment of a standard of surgical competency by the establishment of a surgical certificate will discourage such men from doing surgery they are not qualified to perform.

Some of these younger men who have had little surgical experience will become associated with experienced ophthalmic surgeons. Here, by the experience of assisting and doing surgery under a preceptorship type of training under a certified ophthalmic surgeon, they may become competent surgeons. Thus, a young diplomate whose surgical training and experience may have been inadequate during his training period may afterward develop the training through experience that would permit him to qualify in the examination and certificate.

From what has been said, it seems apparent that a second examination in ophthalmic surgery is necessary.

Elsewhere, in this issue of THE AMERICAN JOURNAL OF OPHTHALMOLOGY (page 189), is an announcement of the proposed surgical examination.

While at first glance the requirements seem to be difficult, a little study and thought given to the matter would seem to indicate that the demands are not excessive. If certification in surgery is to accomplish the desired end, the examination must not permit the unqualified ophthalmologist to attain this certificate. It is self-evident that experience will make it necessary gradually to make certain alterations in the examination.

The board is to be congratulated upon its policy of establishing the precedent of no certificate without some form of examination, with one exception. In order to establish an initial group of certified ophthalmic surgeons to conduct the examination of active board members, former board members interested in surgery will be certified without examination. This includes the names of some of our most outstanding ophthalmic surgeons. This group will conduct the examination of active board members requesting certification in ophthalmic surgery. To be certain that the examination given to the board members is not just a perfunctory or token examination, the case histories submitted by the board members to this special committee will be identified by a number whose designation will be known only to the registrar of the board.

The granting of certification to ophthalmologists who have been in practice for 20 years and who hold important teaching positions without requiring case histories is justified. This group, however, will be required to take the written and the practical examination. This will exclude those faculty members in whom certification is not warranted.

There is a possibility that the American

College of Surgeons may in the future require the surgical certificate of the American Board of Ophthalmology and use it as a prerequisite for Fellowship in Ophthalmic Surgery. If this is adopted, it will mean that the letters, F.A.C.S., after an ophthalmologist's name will be of real significance.

It is self-apparent that there will be opposition to the establishment of the surgery examination, as there always is to any change that leads to elevation of existing standards. This was certainly true when the American Board of Ophthalmology was established. In fact, the heads of some teaching institutions went so far as to tell their young men not to take the examinations. And yet, it is well-established that over the years the board has been a very important factor in bringing about improved training facilities, and it has done this without establishing a rigid, uniform method of training. Another very definite effect of the establishment of the American Board of Ophthalmology was the elimination of the so-called "six weeks' specialist." This was the general physician who decided to specialize and went to a so-called "specialist college" for six weeks to three months and returned as an "eye specialist" or, more frequently, as an "eye, ear, nose, and throat specialist."

Just as the establishment of the board has elevated the standing of ophthalmology and saved many eyes, so the establishment of a standardization of surgical competency will eventually be beneficial in preventing many surgical disasters.

It is hoped that the new venture of the American Board of Ophthalmology will receive the support of all certified ophthalmologists.

Frederick C. Cordes.

VITREOUS TRANSPLANTATION

At the 1956 meeting of the American Academy of Ophthalmology and Otolaryngology, Dr. Donald M. Shafer gave new impetus to use of the vitreous transplantation procedure with his presentation of cases of detached retina that had been operated upon unsuccessfully but subsequently were cured by injection of vitreous filtrate into the vitreous cavity.

The vitreous from the donor eye, or eye-bank eye, was withdrawn with a 16-gauge needle and stored at 4°C. until used. Under these conditions, bacterial growth was not supported. Cultures were negative even after several months, and the effectiveness of the vitreous was not altered by prolonged storage.

The vitreous was injected with a 16-gauge needle through a sclerotomy wound at the pars plana into the vitreous cavity. Mattress sutures were so placed as to pull the sclera tightly around the needle in order that sufficient vitreous be retained to harden the eye.

After transplantation of vitreous, fixed retinal folds and bands tended to disappear. The injected vitreous, although only a filtrate, evidently had such viscosity as to leak out of the wound less readily than would saline or cerebrospinal fluid, tamponading the retina against the choroid more permanently than do these fluids or air, and forcing the escape of subretinal fluid.

When one realizes that vitreous drawn through a needle of this caliber must represent primarily a filtrate composed of 99.7-percent water, 0.062-percent hyaluronic acid, and about 0.24-percent electrolytes and soluble protein, its effectiveness in this procedure becomes difficult to explain. The incompleteness of our knowledge of the vitreous with regard to possible enzyme reactions and colloid chemistry affecting gelatination becomes apparent.

When vitreous transplantation was first advocated by Dr. Norman L. Cutler during the second world war, as published by him in 1946, and later used by Dr. Milo Fritz working at the Eye-Bank in New York, many of us ridiculed their ideas, thinking we knew that the effect of such vitreous could be no more than that of saline, and probably less than that of air.

In retrospect, we see the danger of deduc-

tive reasoning in the face of incomplete knowledge and the value that can come from experiments by trial and error, even when the experiments seem futile as judged by existing criteria. Too often medical progress is retarded by armchair theorists and we must be grateful for the bold adventurous spirits who attempt new procedures that seem practical to them although their value cannot be explained on a theoretic basis.

Now the theorist must explain how vitreous, this peculiar substance with such high water and such low protein content, accomplishes the desired result in this situation.

Is it by the action of enzymes causing liquefaction of remaining formed vitreous, particularly that microscopic cortical layer that may be adjacent to the retina?

Is it due to increase in turgescence of the vitreous by addition of more hyaluronic acid?

Could a solution of hyaluronic acid be substituted for vitreous in this procedure?

Could vitreous in the anterior chamber be liquefied by injection of a donor's normal vitreous?

All these and many other questions remain to be answered. We must salute the results coming from the Eye-Bank for Sight Restoration, Inc., which are opening up new vistas of information and providing answers because of the advantage of having a supply of donor eyes. Information and value far in excess of the original goal of procuring corneas for transplantation have been derived from the work of this organization, parent of similar organizations throughout the country. Congratulations to Dr. Shafer and his co-workers!

S. Rodman Irvine.

OBITUARIES

GABRIEL PIERRE SOURDILLE
(1901-1956)

When Professor Sourdille died on August 19, 1956, France lost a great ophthalmologist and many throughout the world a dear friend. His unusual vitality, his varied interests outside of medicine, his kindness, and the youth he had preserved made of him a most attractive and lovable personality.

He was born in Nantes, a port city in western France well known to many Americans during the first and second World Wars. His family has been distinguished in medicine for several generations; his father, Gilbert Sourdille, who survives him, had been professor of ophthalmology at the Nantes medical school and his uncle, Maurice Sourdille, professor of ear, nose, and throat.

His early medical training was in Nantes but later he moved to Paris where he was a resident of Victor Morax and of Terrien between 1925 and 1929. During the same

Gabriel Pierre Sourdille

period he worked on neurohistology with Nageotte, on neurology and neuro-surgery with Clovis Vincent.

After writing a thesis in 1930, on the treatment of retinal detachment, which was awarded a silver medal by the medical school, he returned to Nantes where he was soon put in charge of the Ophthalmic Service (1933) and a few years later appointed professor of ophthalmology, when his father retired in 1937.

Sourdille, after his residencies, traveled in Europe, and while in Prague he was very much impressed by the work of Elschnig, particularly in cataract operations and corneal transplants. When he returned to Nantes he became one of the pioneers in France of routine intracapsular surgery and continued working on corneal grafts. He became an authority on the latter and, in 1948, with Louis Paufique and Guy Offret, he wrote a book on corneal transplantation which is a classic. Besides, he published many papers in the French *Archives* and was very active at the meetings of the French society where he served on the committee for six years.

He was also a founding member and one time president of the Ophthalmological Society of Western France and had been elected to several foreign societies. He was a great traveler, in many countries, particularly Yugoslavia, Canada, and South America, where he lectured and showed his surgical films. In 1954, he took part in the symposium on glaucoma held in Canada and, at the XVII International Congress in New York, he read one of the opening papers on the surgery of glaucoma. Before this he had already been twice in the United States, in 1947 and in 1949, when he had been invited by Dr. Townley Paton to attend a symposium on corneal transplantation, in New York.

Sourdille was a fine clinician and an excellent surgeon, and his qualities had been recognized by several decorations, in particular the award of the Legion of Honor in 1948. In his leisure hours he was an enthusiastic yachtsman and was president of the La Baule Yacht Club.

During his last summer he had felt unusually tired and had been concerned by repeated hemorrhages. Finally he had his blood examined. When the laboratory report came back, it was clear to him that he had acute leukemia and that the end could not be far. With remarkable coolness and courage he made the best of the last few days left to him, giving advice to his family and assistants and putting his affairs in order. His death was a serious blow to his many friends in France and in other countries. They will long cherish his memory.

He is survived by his charming and devoted wife, Monique Hervouët, by a son and three daughters and by his father, Prof. Gilbert Sourdille.

Edward Hartmann.

* * *

All ophthalmologists of the western hemisphere who were fortunate to know him, and there are many, received the news of Gabriel Sourdille's sudden and unexpected death with profound shock and great sorrow. He was an exceedingly gifted and modest man, whose capacity for making firm friends and sincere admirers was extraordinary, in spite of language difficulties. In light moments he was a happy companion, in serious and scientific times he was an amazingly well-informed scholar of great originality and integrity, whose learned contributions excited and stimulated us to better endeavors. He belonged to us all, not just to his native France, and we shall miss him from our circles.

Derrick Vail.

TRUMAN L. BOYES
(1898-1956)

Dr. Truman L. Boyes died at the age of 58 years on October 17, 1956, almost at the same hour that his friends and co-workers

were sending their best wishes from a meeting of the New York Eye and Ear Infirmary alumni in Chicago. Everybody liked Truman and his passing was a personal loss. He is survived by his mother, a brother, and three sisters.

Born in Glanford, Ontario, Dr. Boyes obtained his medical degree from the University of Toronto in 1922. He came to New York that same year for postgraduate work at Bellevue and Long Island College Hospitals. He was naturalized in 1932.

From the beginning Dr. Boyes was active in ophthalmology, eventually becoming full attending surgeon at the New York Eye and Ear Infirmary. He was consultant to St. Mary's Hospital and the Good Samaritan Hospital at the time of his death.

He was a natural teacher, interested and adept in all phases of his work, and able to impart some of his enthusiasm to his many students. Although his greatest interest was in the field of extraocular muscles, those whom he instructed in other branches of ophthalmic medicine and surgery will recall his thoroughness and insistence upon careful work in everything that he did.

Dr. Boyes was active in his medical societies, local, state, and national, holding offices of secretary or chairman in the New York Ophthalmological Society and the New York Academy of Medicine. Other societies included the Celtic Medical Society, the American Academy of Ophthalmology and Otolaryngology, American College of Surgeons, Pan-American Association of Ophthalmology, and the Physician's Scientific Society.

Truman will be remembered always for his friendliness, a genuine out-going amiability that was too busy liking people to notice their faults. At home in any group, he was articulate without being forward and agreeable even without always agreeing.

He was everybody's friend, cheerful and willing to take part in any kind of work or play. He never spoke of his own troubles but was always ready to help the other fellow... Truly a Christian gentleman, his guiding motto seemed to be *nihil nisi bonum*. There are too few gentle spirits like him and we shall miss him.

Willis S. Knighton.

BOOK REVIEWS

ENDOGENOUS UVEITIS. By Alan C. Woods, M.D. Baltimore, Maryland, The Williams and Wilkins Company, 1956. 293 pages, 81 illustrations, 42 colored plates, bibliography, index. Price: $12.50.

At a meeting of the Section on Ophthalmology, A.M.A., held in Saratoga, New York, June, 1902, a symposium on uveitis was presented. The participants were de-Schweinitz, Harry Friedenwald, H. F. Hansell, W. H. Wilder, T. A. Woodruff, W. B. Marple, and Hiram Woods. The latter spoke on an "Analysis of thirty-seven cases of uveitis," and opened his remarks by saying "The form of uveitis I propose to consider is choroido-cyclitis. These cases divide themselves naturally into those with and without descemetitis," a prophetic statement.

The papers were collected and published in a slender volume of 91 pages by the A.M.A. It is safe to say that they represented the peak of the knowledge of this subject 54 years ago, and even today one can read them with profit and enjoyment.

This symposium and the book by Alan Woods under discussion, which he affectionately dedicates to the memory of his father, Hiram Woods, is the contrast between medicine of the "horse and buggy" days and that of the present. In spite of many things that are still unknown on this subject, it frequently discloses the thrilling advances we have made.

For many years a clinical distinction was made between the "serous" or rheumatic form of uveitis and the "plastic" form. I believe it was Koeppe who was among the first to distinguish between the two by classification of the types of cells found by slit-lamp microscopy in the anterior chamber, on

the posterior surface of the cornea, and in the iris, and utilized them as a tool for clinical diagnosis.

Group A (large or mutton-fat cells and the Koeppe nodule) consists of lues, tuberculosis, and sympathetic ophthalmia.

Group B consists of rheumatic iritis, gonorrheal iritis, and ulcus serpens (L. Koeppe, *Die Mikroskopie des lebenden Auges.* Berlin, Springer, 1920, p. 213).

At that time this was a considerable step forward in the classification and diagnosis of the different forms of uveitis and brought much order out of the confusion that is so obvious in the 1902 symposium. Alan Woods has taken us farther down the road toward our goal of complete understanding of this baffling disease. He is extraordinarily well fitted for this task because of a lifetime of study of uveitis, studies that are particularly noteworthy regarding the "serous" or nongranulomatous form which he has conclusively shown, by innumerable patient laboratory and clinical studies, to be a toxo-allergic condition, in most instances. He is a writer of great clarity, vigor, and considerable eloquence, given to sentences that stick in one's mind.

The classification and definitions which he presented some time ago, of "granulomatous" and "nongranulomatous" forms of uveitis have now been generally accepted throughout the world. This is in spite of certain objections that "have been raised to the application of these terms to the two forms of uveitis, on the grounds that the chemical and histologic pictures of both the so-called 'granulomatous' and 'nongranulomatous' inflammations of the eye may vary from the above patterns, that pathologic terms are employed to describe clinical and pathogenic differences, and that at times no pathologic or histologic differentiation between the two entities is possible" (p. 94). The author further says, "The validity of these criticisms must be admitted."

The reason for the wide acceptance of Dr. Woods' term lies, I think, in (a) the ease with which a mental picture of the condition is formed and (b) the usefulness of the differentiation in initiating certain lines of investigation most likely to give results in determining the etiology and treatment. This is, indeed, no small benefaction.

The volume is a noteworthy expansion of a useful teaching manual by the author, first published in 1948 by the American Academy of Ophthalmology and Otolaryngology. Chapter I discusses nomenclature, classification, pathogenesis; chapter II, the clinical picture and pathology of granulomatous and nongranulomatous uveitis; chapter III, the etiologic diagnosis of uveitis; and chapter IV, the treatment of uveitis. They are all scientifically sound.

The illustrations and particularly those in color are extraordinarily good and well chosen. The book is beautifully printed and adequately indexed. It is a fine work and a contribution to our knowledge which we are most proud to accept with gratitude.

Derrick Vail.

DIABETES MELLITUS. By Howard F. Root, M.D., and Priscilla White, M.D. New York, Landsberger Medical Books, Inc., 1956. Price: $7.00

The prolongation of the life of the diabetic patient since the introduction of insulin has presented the ophthalmologist with the frustrating problem of diabetic retinopathy and its attempted prevention and control. For a better understanding of the diagnosis and management of diabetes mellitus this new book by Root and White of the famed Joslin Clinic should be read by every ophthalmologist confronted with the ocular complications of this disease (and what ophthalmologist is not?).

The authors feel that the increase in retinal changes, along with calcification of the vessels and nephropathy is much less in patients under good control, especially as evidenced by elevated blood cholesterol and lipoprotein values.

Among the ocular complications are mentioned: xanthoma, abnormal pupillary reactions including Argyll Robertson pupils (in patients with diabetic neuropathy), transitory changes in refraction, muscular paralyses especially of the external rectus, cataracts, vitreous opacities and hemorrhages, lipemia retinalis, and retinopathy. The various stages of diabetic retinopathy are described and although these usually occur only in patients with long-term diabetes they mention seven cases in diabetics of less than two years' duration and two before 20 years of age. The incidence of blindness in long-term young diabetics is given as 10 percent. Diabetes is given as the cause of 17 percent of the blindness in the State of Massachusetts. Prevention through the proper control of the disease is felt to be the best answer to this problem. In an attempt to treat retinopathy, the authors mention rutin (up to 1,000 mg. per day), vitamin P, vitamin B_{12}, Heperiden, and estrogens, but express no enthusiasm. They advise against such radical treatment as hypophysectomy, which has been advocated.

The management of diabetics undergoing surgery is discussed in detail, as well as the influence of pregnancy.

Of interest is the study of the conjunctival blood vessels, paralleling the retinal changes, especially in the juvenile diabetic. In a study of 189 cases of juvenile diabetes of 20 years' duration three percent of well-controlled cases showed retinopathy but 31 percent of poorly controlled cases showed severe retinopathy.

William A. Mann.

ORBITAL PLASTIC. By Dr. I. Csapody. Budapest, Akadémia Kiado, 1956. 2nd edition. 112 pages, 90 illustrations, 7 tables, bibliography. Price: Not listed.

The first edition of *Orbital Plastic*, published in 1953, was reviewed in this space in October, 1954. The fact that a second edition has appeared so soon is an excellent indication that the volume is being accepted by the profession as a guide for a procedure from which the majority of ophthalmic surgeons shy away.

Csapody has changed the atypical procedures ordinarily employed for plastics of the contracted socket to a typical procedure. This he has accomplished by means of a uniform metal pattern for full-thickness grafts and a mold of his own construction.

Csapody has been able to add 20 new cases to the 150 cases on which the first edition was based.

He has given a very detailed description of his mold with precise measurements. A skilled instrument maker should be able to follow these instructions without difficulty.

A welcome improvement is the description of the operation: instead of a narrative, the text has been broken up to serve as legends for the illustrations which make it much easier to follow the description of the procedure step by step.

Credit should be given to the publisher for using glossy paper. This permits a much more brilliant reproduction of the illustrations.

Stefan Van Wien.

COMPARATIVE ANATOMY OF THE EYE. By Jack H. Prince, F.R.M.S. Springfield, Illinois, C. C Thomas, 1956. 418 pages, 274 illustrations, including seven in color, bibliography, index. Price: $8.50.

In this contribution, Dr. Prince, formerly of London and now with the Department of Ophthalmology of Ohio State University, amplifies the adaptive mechanisms in comparative ophthalmology and thus complements his volume on *Visual Development* (1949) which was concerned primarily with evolutionary patterns.

Among the carnivores the protective enclosed orbit has become continuous with the temporal fossa to allow a greater gape and

power of jaw movement. In the predatory animals the eyes are placed well forward, while the hunted have them to the side for the attainment of wide panoramic vision. The habits of animals can be assessed by their retinal structure, since the rods are primarily scotopic and the cones photopic. The ancestral receptor was probably the cone, as light recognition must have begun in daylight. Diurnal birds lead in visual acuity which is eight times that of man according to reliable estimates. Many birds have two foveas, one at the optic axis and the other at about 30 degrees to it, which allows the laterally placed eyes to obtain a perfect image from ahead. The eyelids of birds are closed only in sleep, the nictitating membrane functioning at all other times.

The tapetum, present in ungulates and carnivores, is invariably in the lower half of the fundus, thus reducing overhead glare. Fish, amphibians, and reptiles lack pathways between the lateral geniculate nuclei and the cortex. The Edinger-Westphal nucleus is only found in the higher vertebrates; it does not appear in the human embryo until the seventh month. It was discovered by Edinger in embryonic material and later identified by Westphal in adults. The activity of the retina is reflected by the thickness of the choroid which is greatest in birds; then comes that of man and mammals. All the other variations and their implications are thoroughly discussed.

Comparative ophthalmology has fascinated many celebrated ophthalmologists including Casey Wood, Lindsay Johnson, Duke-Elder, Magitot, Bailliart, and Rochon-Duvingneaud. This book is both a delightful reading experience and a valuable reference treasure.

James E. Lebensohn.

OCULAR SURGERY. By H. Arruga, M.D. Translated from the fourth Spanish edition by Michael J. Hogan, M.D., and Luis E. Chaparro, M.D. New York, McGraw-Hill Book Co., Inc., 1956. 948 pages, 1309 illustrations. Price: $48.00.

At first glance it would seem that the 12 additional pages in this new edition are among the most expensive in the field of textbook publishing, exactly one dollar per page. However, at any price this is a monumental book and publishing costs for such a handsome volume must indeed be enormous.

Sixteen illustrations have been added in this latest edition. There is a more complete discussion of acrylic implants in cataract surgery and a diagrammatic presentation of insertion of a "Strampelli" lens into the anterior chamber in a case of high myopia. The section on retinal detachment devotes an extra page or two to scleral shortening procedures. However, the bulk of added material concerns itself with the buried peg-implant devised by the author.

Aside from the magnificent presentation of technical detail, this book is of great historic interest, particularly for the American-trained ocular surgeon who very often feels that all his surgical techniques were devised yesterday in New York or Boston or Baltimore or even in Chicago. The ophthalmologist who does not own the first English edition is advised to hasten out and purchase this one before it too is out of print.

David Shoch.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Ashton, N., Brini, A. and Smith, R. **Anatomical studies of the trabecular meshwork of the normal human eye.** Brit. J. Ophth. 40:257-282, May, 1956.

The eyes used in this study were removed at autopsy or enucleated for melanosarcoma. They were sectioned in three different planes; the antero-posterior, the tilted frontal and the flat sections.

The findings generally conformed to the findings reported by others. The connection between the anterior chamber and Schlemm's canal was shown to be not a system of endothelialized canals, but rather open pathways as tortuous communications wandering irregularly and obliquely throughout the meshwork, like channels through a sponge. (23 figures, 42 references) Morris Kaplan.

Calmettes, Deodati, Planel, and Bec. **Histologic and histochemical study of the superficial and basal epithelium of the cornea.** Arch. d'opht. 16:481-506, June, 1956.

The authors have studied the epithelium of intact human corneas and of the corneas of cattle, horses, donkeys, pigs, dogs, rabbits, guinea-pigs and rats by histological and histochemical methods. Studied particularly by histochemical methods were the carbohydrates, the nucleic acids, and the lipids of the epithelium. Morphologically the authors found the epithelium in general to be identical in all species studied with only a few variables related to the number of cell layers and thickness. The authors illustrate these variables in chart form and in photographs of histological sections. They describe in detail the various morphologic characteristics of the epithelium in its various layers and locations. They note particularly that in neither man nor animal was there any sign of keratinization. In the histochemical study they noted that ribonucleic acid varied in concentration and location according to species but that in man it occurred in the form of small granules in the basal cells. They found glycogen in small amounts in epithelium of all species while the glucidolipidic compounds were found predominantly in the most superficial layer. They conclude with a discussion of the origin and histochemistry of the basal membrane of the epithelium. The article is abun-

dantly illustrated with photographs in black and white. P. Thygeson.

Kurus, Ernst. **The morphology of the ciliary ganglion.** Klin. Monatsbl. f. Augenh. **129**:183-196, 1956.

On the basis of some morphologic studies and histochemical stainings the author could distinguish the three main groups of ganglion cells in the ciliary ganglion: sympathetic, parasympathetic and sensory. (6 figures) Frederick C. Blodi.

O'Day, Kevin. **The value of the study of the comparative anatomy of the eye.** Tr. Ophth. Soc. Australia **15**:144-146, 1955.

In the past many erroneous conclusions have been deduced by reasoning from the observations on the eye of one species as to what might be expected to occur in another. The author quotes examples of faulty observation upon which extensive theories have been built; namely, Elliot Smith's theory of the development of the neo-pallium and Chavasse's theory of the development of parallel eyes with acute central vision. (4 references)
Ronald F. Lowe.

Rohen, Johannes. **The insertion of the ciliary muscle in the structures of the chamber angle.** Ophthalmologica **131**:51-60, Jan., 1956.

In thick (80-120 μ), lightly stained, tangential sections through the outer corneoscleral wall of the chamber angle, the author has been able to trace tendinous anterior terminations of ciliary muscle fibers into the innermost layers of the trabecular system and from there into the cornea. "The elastic fiber nets in the inner wall of the canal of Schlemm must be considered as the actual point of insertion of the anterior ciliary muscle tendons." This finding supports the concept of facilitation of aqueous passage through the trabeculae due to changes in ciliary muscle tone. (5 figures, 21 references) Peter C. Kronfeld.

Shea, Michael. **Carotid-ophthalmic anastomoses. Frequency of external carotid and ophthalmic artery anastomoses.** Brit. J. Ophth. **40**:497-501. Aug., 1956.

Autopsy material was used in this study to ascertain the degree of anastomosis between the external carotid artery and the ophthalmic artery. Since an inadequate anastomosis could well pose a serious threat to vision in the event of surgical correction for carotid-cavernous fistula, it becomes evident that this study has definite clinical application. Satisfactory testing for this degree of anastomosis was possible by perfusing with water, air and blood. Patency of the homolateral anastomosis was found in 91.8 percent while patent contralateral anastomosis was present in 31.8 percent of cases. Based upon this evidence as well as on a review of clinical evidence it would seem that the ipsilateral anastomoses are adequate to preserve vision in those requiring occlusion of the ophthalmic artery near its point of origin. If one relied on the contralateral anastomosis alone the risk would obviously be greater. (3 tables, 13 references) Lawrence L. Garner.

Taptas, Jean N. **The area of the cavernous sinus, its constitution, and its relation to the vessels and nerves which traverse it.** Arch. d'opht. **16**:404-412, June, 1956.

The author, in an anatomical study of the cavernous sinus, concludes that the classical descriptions of the space are not in accord with the embryological observations on the development of the cephalic extremity. He concludes that current explanations for the development of arteriovenous aneurysm in pulsating exophthalmos, either post-traumatic or spontaneous, are not acceptable and refers to his own

explanation (Arch. d'opht. 10:22-50 (no. 1), 1950).

He states that one cannot conceive anatomically of involvement of the oculomotor nerves in the region of the sphenoidal fissure due to opticochiasmal arachnoiditis as has recently been claimed by French and American authors. He also maintains that it is not anatomically possible to have transmission of infection from the facial cavities (sinuses, orbits, nasal fossae) to the arachnoid spaces (especially the opticochiasmatic spaces) by a venous route. He concludes that the veins which drain these spaces pass only extradurally. P. Thygeson.

Warwick, Roger. **Oculomotor organization.** Roy. Coll. Surg. Ann. 19:36-52, July, 1956.

The study of anatomic and physiologic oculomotor organization is reviewed from the time of Stilling to the present. The author's eight year study of this system in rhesus monkeys, apes and man, using the Nissl acute retrograde degeneration technique, is summarized. He confirmed the belief that the trochlear pathway is wholly crossed and supplies only the superior oblique muscle; and that the abducent pathway is wholly direct and supplies only the lateral rectus muscle. However, he found that the arrangement of nuclei supplying the other five extraocular muscles was markedly different from the classically accepted Bernheimer-Brouwer representation. Also he determined that the inferior and medial rectus muscles and the inferior oblique are supplied directly; the superior rectus has a contralateral supply; and the levator's innervation is bilateral. He determined that Perlia's central nucleus is not a convergence center. The accepted ocular parasympathetic pathway is confirmed with minor reservations. (11 figures, 44 references) Harry Horwick.

Wolter, J. Reimer. **Special astrocytes on the inner surface of the retina.** Klin. Monastbl. f. Augenh. 129:224-230, 1956.

In flat sections of the retina, especially near the posterior pole, numerous flat cells can be found on the internal limiting membrane of normal retinas. These cells are quite numerous in various retinal diseases. Stained with silver carbonate they are star-shaped with a long, oval nucleus. These cells appear to belong to the neuroglia. (5 figures, 18 references)

Frederick C. Blodi.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Bo'br-Porwit, Z. and Bulanda, M. **Influence of chloromycetin and other antibiotics on gram-negative bacilli found in the conjunctival sac.** Klinika Oczna 26:47-52, 1956.

The authors examined 126 strains of gram-negative bacilli collected from 787 patients with conjunctivitis. Proteus vulgaris was found in 47 percent of cases, Aerobacter aerogenes in 46 percent, Pseudomonas aeruginosa in 4 percent and Escherichia coli in 3 percent. Their sensitivity to different antibiotics was checked. The action of chloromycetin was compared with that of aureomycin, streptomycin, terramycin, penicillin and sulfathiazole. Tests were made on bouillion culture and plates. The results were the same with both methods. It was found that the gram-negative bacilli are quite resistant to the influence of antibiotics. High concentration had to be used to obtain desired results. Chloromycetin and terramycin appeared to be the most efficient; however, chloromycetin seemed to be superior because of less irritating effect on the conjunctiva. (2 figures, 2 tables, 11 references) Sylvan Brandon.

Hirose, K. and Yoshioka, H. **Histopathological study of anencephalic eyes.**

I. Retrolental fibroplasia in anencephalic eyes. Acta Soc. Ophth. Japan **60**:937-946, Aug., 1956.

Thirty eyes from 15 anencephalic fetuses were examined histologically. In three of the 30 eyes, a finding corresponding to retrolental fibroplasia was found. In such cases, there was a delay in the physiologic degeneration in the fetal zone of the adrenal gland. The authors thus incline to the view that the retrolental fibroplasia is of more "congenital" than postnatal origin and that the condition has a relation to the adrenal gland. (23 figures, 26 references)

Yukihiko Mitsui.

Mitsui, Y. and Suzuki, A. **Electron microscopy of trachoma virus in section.** A.M.A. Arch. Ophth. **56**:429-448, Sept., 1956.

This is a report of the study of the morphology of the cultured trachoma virus in thin sections. Interestingly, the authors were not able to find any virus-like structure in the subepithelial tissues of trachomatous conjunctiva. (28 figures, 5 references) G. S. Tyner.

Mizukawa, T. and Kizu, S. **Allergic reaction of the eye by lens protein. III. Skin test.** Acta Soc. Ophth. Japan **60**:930-936, Aug., 1956.

In this study of the skin reaction for lens protein allergy, the authors injected 0.1 ml. of one percent solution of lens protein into the skin of the forearm. According to their analysis, an erythema of larger than 15 mm. in diameter, which may occur 48 hours after the injection, should be regarded as "positive." In about ten percent of normal individuals this reaction is positive. In one of the 12 cataractous patients the reaction became positive after surgery. (6 figures, 4 tables, 29 references) Yukihiko Mitsui.

Scadding, J. G. **Sarcoidosis.** Tr. Ophth. Soc. U. Kingdom **75**:173-180, 1955.

The author discusses sarcoidosis as a disorder which may affect any part of the body but most frequently the lymph nodes, liver, spleen, lungs, skin, eyes and small bones of the hands and feet. It it characterized by the presence in all affected organs or tissues of epithelioid cell tubercles without caseation and with little or no round-cell reaction, which become converted in the older lesion into a hyaline featureless fibrous tissue. He feels that it is a variety of tuberculosis, and cortisone can cause dramatic clearing, but the lesions frequently recur. (9 references) Beulah Cushman.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Becker, B. and Christensen, R. E. **Beta-Hypophamine (Vasopressin).** A.M.A. Arch. Ophth. **56**:1-9, July, 1956.

This drug, similar to the vasopressin hormone of the posterior pituitary, produces a fall in intraocular pressure in normal and glaucomatous eyes when applied topically. It acts by suppression of aqueous flow. Its usefulness is probably limited to short term application because of rapid development of a resistant state by the eye. (2 figures, 4 tables, 18 references) G. S. Tyner.

Binder, R. F. and Binder, H. F. **Studies on aqueous passages in the eye of the rabbit.** A.M.A. Arch. Ophth. **56**:10-15, July, 1956.

After fluorescein injection into the anterior chamber of rabbit eyes, aqueous veins and tongue-like extensions were observed in normal eyes. These channels were observed in two glaucomatous eyes. Observations in eyes subjected to previous cyclodialysis and iridencleisis were inconclusive. (4 figures, 11 references)

G. S. Tyner.

Campbell, D. A. and Tonks, E. M. **Experimental exophthalmos in rats due to thiouracil and cortisone.** Tr. Ophth. Soc. U. Kingdom **75**:605-622, 1955.

The authors found that within the limits of their experiments on a small number of animals, thiouracil caused a mild degree of exophthalmos which was probably due to the uninhibited action of thyrotropic hormone in a state of depressed activity of the thyroid. Cortisone caused exophthalmos in rats when acting alone, but its action was greater in animals previously treated with thiouracil. Thiouracil does not appear to be a safeguard against the occurrence of exophthalmos and the latter may be exacerbated during treatment by exposure to stress. (6 figures, 6 tables, 11 references)
Beulah Cushman.

Campbell, D. A., Tonks, E. L. and Jones, M. **Correlation of the systemic and intra-ocular effects of diamox.** Brit. J. Ophth. **40**:283-294, May, 1956.

In the present study simultaneous records we made of intra-ocular pressure, of the amount and rate of diuresis and of the variation of sodium and potassium in the blood and urine after initial doses of diamox. Each subject received the same hospital routine and the same controlled fluid intake. Great differences in intra-ocular pressure were found among subjects but none was found between eyes of the same subject even though one eye had been trephined. The intra-ocular pressure generally fell within the first two hours both in normal and in glaucomatous eyes and this fall corresponded directly with a fall in serum sodium and an increased rate of excretion of urine and of urinary sodium and potassium. These results indicate that the intra-ocular changes brought about by diamox are entirely part of the systemic changes as a whole and that any speculation on the mode of action of the drug upon the eye is necessarily bound up with its mode of action in the body as a whole. (5 tables, 15 references) Morris Kaplan.

Casanovas, J. and Bruix, J. **Prednisone in ophthalmology.** Arch. Soc. oftal. hispano-am. **16**:438-448, March-April, 1956.

Ten cases in which prednisone was used are reported. It is concluded that this agent has the same therapeutic indications as cortisone and hydrocortisone. Locally it is as efficient and tolerated as well. For general therapy it is effective in smaller doses and is less hazardous. (38 references) Ray K. Daily.

Collins, F. D. **The biochemistry of vision.** Tr. Ophth. Soc. Australia **15**:28-38, 1955.

The data on photosensitive retinal pigments and their absorption spectra are reviewed. (9 figures, 12 references)
Ronald F. Lowe.

Damiani, A. **The effect of Recorcain on the light sensitivity threshold and on the visual fields.** Gior. ital. oftal. **9**:133-140, Jan.-Feb., 1956.

Tests on 20 subjects showed a lowering of the light sensitivity threshold, which was more marked when the drug was injected retrobulbarly than when it was injected intravenously. There was no effect on the visual fields. (2 figures, 26 references) V. Tabone.

Duke-Elder, S., Perkins, E. S. and Langham, M. E. **The clinical and physiological effects of diamox.** Arch. Soc. oftal. hispano-am. **16**:259-274, March-April, 1956.

The literature on the clinical use of diamox is reviewed, and its effect on the raised ocular tension in acute closed angle, in simple, and in secondary glaucoma is demonstrated graphically by illustrative cases. In a series of seven cases

diamox hastened the restoration of flat postoperative anterior chambers in five. Summarizing the clinical data, the authors point out that there are about 15 percent of cases in which diamox has no effect, and that it has no influence on the etiologic factors responsible for the raised ocular tension. The chief field of usefulness of this drug is in acute cases, in which it eliminates the need for surgery under unfavorable conditions, and in secondary glaucoma in which surgery is contraindicated. In chronic glaucoma it is indicated when miotics are ineffective and when surgery is for some reason contraindicated. The experimental work was directed to the elucidation of the physiologic effects of this drug. The literature is reviewed and the experimental data, using anesthetized rabbits and the fluorescein concentration in the aqueous as a test, are reported in detail. The results of these experiments show that diamox diminishes by about 25 percent the passage of aqueous from the posterior into the anterior chamber. It is interesting that in rabbits the subconjunctival injection of 10 mg., of diamox completely inhibited the carbonic anhydrase of the iris and ciliary body within 15 minutes. In man, the local administration of diamox has no effect on the ocular tension, in spite of the inhibition of the carbonic anhydrase. Therefore it does not seem probable that the effect of diamox on the eye is based on a local effect on this enzyme in the eye. Another interesting feature of the experimental study was the demonstration of an increase in the ascorbic acid content of the rabbit eye after the administration of diamox. Further studies dealt with the effect of diamox on the acid-base equilibrium in relation to the blood-aqueous barrier. The data show that diamox modifies the distribution of bicarbonate, but does not eliminate the normal excess of bicarbonate in the aqueous. Correlation of the data of the various experiments seems to indicate that diamox acts in the eye not through the inhibition of carbonic anhydrase, but through a modification of the acid-base barrier between the blood and the intraocular fluids. This hypothesis led to an investigation of the effect on the ocular physiology of ammonium chloride, which acts similarly to diamox on the acid-base barrier. It was found that ammonium chloride acts similarly to diamox in diminishing the flow of aqueous, and not inhibiting the secretory activity of the ciliary body, as judged by the ascorbic acid content. The authors conclude that the reduction of ocular tension produced by diamox is not due to its specific inhibitory action on the activity of carbonic anhydrase in the eye. (6 figures, 4 tables, 17 references) Ray K. Daily.

Ennor, A. H. **Some aspects of the distribution of electrolytes.** Tr. Ophth. Soc. Australia **15**:20-27, 1955.

Some biochemical reactions in the retina and lens are briefly reviewed. (1 table, 18 references) Ronald F. Lowe.

Fornes, E. **Experimental study on the nature of the corneal plexuses.** Arch. Soc. oftal. hispano-am. **16**:455-478, May, 1956.

It is difficult to determine the nature of corneal innervation by morphologic studies alone, and reference is made to Mawas' findings that the cornea contained a sympathetic innervation. The authors conducted an experimental study, the basis of which was to demonstrate the pathologic processes caused by a denervation of the ocular tissues. The material for the investigation consisted of several series of rabbits and cats. In the rabbits, all nervous connections to the eyeball were severed. In the cats, the superior cervical ganglion was enucleated on one side, using the other side as a control. The animals were killed on successive days and the eyes sectioned. The data, illustrated with microphotographs, show that in the

rabbits with the completely severed innervation the cornea became opaque, leading finally to ulceration of the cornea and atrophy of the globe. The cornea did not show any inflammatory reaction or vascularization, the pathologic process consisting principally of an edema of the interstitial tissues. Microscopically there was seen a degenerative process in the nerves, in those of central as well as of sympathetic origin. Interruption of the sympathetic innervation in the cat produced degenerative changes of the sympathetic fibres at the limbus, but lead to no pathologic processes in the cornea. The data thus indicate that the nervous plexuses of the cornea are principally sensory, without any significant participation by the sympathetic system. (15 microphotographs, 59 references)

Ray K. Daily.

Gloster, J. **Carbonic anhydrase in the vitreous body.** Brit. J. Ophth. **40**:487-491, Aug., 1956.

Rabbit eyes were used for trials to determine the presence of carbonic anhydrase in the vitreous by means of a quick freezing technique. These experiments demonstrate that this enzyme is present in the vitreous, particularly in the outer part of the vitreous. The tissues about the vitreous are rich in carbonic anhydrase and it seems that this enzyme originates from this point. That it is not found in the vitreous as a post-mortem change is attested by the presence of the enzyme in eyes removed seconds after death. The amount of carbonic anhydrase is much lower than that found in the tissues adjacent to the vitreous. (2 tables, 20 references) Lawrence L. Garner.

Gloster, J. **Diamox in the treatment of glaucoma; an investigation of the effect of diamox on the intra-ocular pressure of rabbits.** Ophth. Soc. U. Kingdom **75**:219-227, 1955.

Experiments were carried out to discover the effect of diamox on the intra-ocular pressure in rabbits and the rate in which the changes occur. It was found that the intra-ocular pressure effect is the result of changes within and outside the eye. The effect of diamox on the carbonic anhydrase of the renal tubules gives rise to increased urinary output of water and of bicarbonate, sodium and potassium ions with consequent changes in the levels of electrolytes in the plasma. No definite effect was found after subconjunctival use. (3 figures, 15 references)

Beulah Cushman.

Klein, M. and Millwood, E. G. **Preservation of eye solutions against contamination by pyocyanea.** Tr. Ophth. Soc. U. Kingdom **75**:515-522, 1955.

The authors investigated solutions of penicillin for pyocyanea contamination and the effect of some preservatives on the potency of penicillin. They conclude that penicillin should be ordered only when there is real need for it and for as short a period as necessary. A label with the date of expiration should be generally adopted. (2 figures, 10 references)

Beulah Cushman.

Linnen, H. J. and Hammers, H. **Observations on experimental choroidal detachment.** Klin. Monatsbl. f. Augenh. **129**: 319-324, 1956.

A series of albino rabbits were operated on. Cyclodialysis was performed, either alone or together with additional trauma (introduction of dionine, paracentesis). A single trauma will not produce a choroidal detachment, but repeated or combined trauma may precipitate it. The author speculates on the role of a decreased vascular supply to the choroid in the pathogenesis of choroidal detachment. (8 references) Frederick C. Blodi.

Lloyd, J. P. F. **Argemone oil and sanguinarine poisoning in monkeys.** Tr. Ophth. Soc. U. Kingdom 75:431-433, 1955.

The author attempted to produce epidemic dropsy and its accompanying glaucoma with argemone oil and sanguinarine in monkeys. The drainage system for aqueous closely resembles that of the human eye. No definite conclusions were reached as some of the controls showed similar histological changes. (2 references) Beulah Cushman.

Meesman, A. **The antagonistic innervation of the ciliary muscle.** Arch. Soc. oftal. hispano-am. 16:280:292, March-April, 1956.

The author reviews the literature and reports his own investigations, extending over a period of years, using the exposed ciliary muscle of the cat's eye, and human eyes. The effect of pharmacodynamic agents on the ciliary muscle was determined by the response of an exposed section of the muscle to the faradic current; the contractions were recorded photographically with a magnification of 16 diameters. The results demonstrate the presence of an antagonistic innervation in the ciliary muscle, extending over the entire musculature, and not limited to its isolated sections. The sympathomimetic drugs exercise an inhibitory and regulating action on accommodation for distance, beyond that of the position of repose. A sympathicolytic action was also demonstrated by the production of myopia of 0.5 to 0.75 diopters. In the eye of the cat, sympathicolytics act as pure parasympathomimetics. (5 figures, 16 references) Ray K. Daily.

Meyer-Schwickerath, G., Gruterich, E. and Niesel, P. **The effect of Butazolidin on experimental inflammations of the fundus.** Klin. Monatsbl. f. Augenh. 129: 358-365, 1956.

The experimental inflammation was produced at the posterior pole of the rabbit's eye with light coagulation. In the treated animals the injured retinal area remained smaller, but the scarring occurred more slowly. This was probably the result of the inhibition inflammation around the necrotic focus. (7 figures, 12 references) Frederick C. Blodi.

Mikami, H. **Experimental studies on ocular manifestations of vitamin B_6 deficiency.** Acta Soc. Ophth. Japan 60:1236-1255 Aug., 1956.

This is a study of vitamin B_6 deficiency in young rats and rabbits. Clinically blepharitis, blepharoconjunctivitis and corneal vascularization result. In histologic preparation one finds corneous hyperplasia of the epithelium and chronic infiltration in the corium and hypoderma; in the skin of lid margin subepithelial infiltration with lymphocytes and plasmacells of the palpebral and bulbar conjunctiva; and in the cornea, vacuole formation in the epithelium and vascularization of the superficial layer of the substantia propria accompanied by perivascular infiltration. It is interesting to know that the Morax-Axenfeld bacillus, which is nonpathogenic to animals in general, causes inflammation when inoculated into the eye of these animals, and the bacillus can be re-isolated from the lesion, whereas nothing develops in control animals. (14 figures, 11 tables, 37 references) Yukihiko Mitsui.

Miyazawa, M. **Effect of stress on ascorbic acid metabolism.** Acta Soc. Ophth. Japan 60:1280-1288, Sept., 1956.

The content of ascorbic acid in urine was measured on guinea pigs during stress due to oscillation, cold, and epinephrine injection. Ascorbic acid (reduced form) in the urine decreased gradually after alarming stimuli. The same thing occurred in the adrenal gland. Miyazawa thus supposes that stress may

play a role in the process of development of senile cataract. (5 figures, 9 tables, 16 references)

Yukihiko Mitsui.

Nakamura, M. **Metabolism of crystalline lens. III-IV. Enzymatic oxidation of pyruvate in normal and cataractous lens.** Acta Soc. Ophth. Japan **60**:291-299, and 924-930, May and Aug., 1956.

An emulsion of the lens has a catabolic activity to pyruvate. The cortex is most active and then the nucleus and capsule. An addition of vitamin B_1 accelerates the activity while that of vitamin B_2 suppresses it, though in a slight degree. A definite suppression occurs by a cyanide.

The lens with cataract due to naphthaline gradually losses this catabolic activity until a complete disappearance results with maturing of the cataract. In the incipient stage of the cataract, the loss of the catabolic activity is chiefly due to a disappearance of co-enzyme. It can be reactivated, therefore, by the addition of a heated emulsion of normal lens or of cocarboxylase. In the mature stage, however, there is a complete loss of apoenzyme. (12 figures, 11 tables, 37 references)

Yukihiko Mitsui.

Ohta, T. **Mucopolysaccharides in pathogenesis of experimental exophthalmos. III.** Acta Soc. Ophth. Japan **60**:1310-1322, Sept., 1956.

A definite exophthalmos results when thyrotropin is injected by itself or in combination with ACTH into thyrectomized guinea pigs. The dosage of thyrotropin is 30 J.S.U. per day and that of ACTH is 40 I.U. per day. The duration of administration is three weeks. The exophthalmos begins to appear after one week's administration. An edema and an increase in hyaluronic acid are found in the retrobulbar tissues of such animals. (8 figures, 5 tables, 75 references)

Yukihiko Mitsui.

Da Pozzo, Ezio. **Toxicity of streptomycin to the optic nerve.** Gior. ital. oftal. **9**: 190-194, Jan.-Feb., 1956.

The author reviews the toxic effects of streptomycin on the eye, particularly when used in tuberculous meningitis. He believes that optic atrophy in such cases is more likely to be due to the meningitic process than directly to the use of the drug.

V. Tabone.

Ros Pena, R., Casado Corso, J. P. and Carreras Matas, B. **Electrophoresis of subretinal fluid.** Arch. Soc. oftal hispanoam. **16**:449-454, March-April, 1956.

The centrifuged subretinal fluid aspirated from a perforating diathermy puncture was examined by paper chromatography. The curves in both cases showed an absence of alpha-globulin. There was no appreciable modification in the relation of beta-globulin to that of the patient's serum in one case, and a slight increase in the other. The gamma-globulins were decidedly diminished. The curves resemble those of transudates, which differ from exudates in that in the latter, the alpha as well as the beta globulins are increased. (5 figures, 1 reference)

Ray K. Daily.

Rubino, A. **Vegetative eye.** Gior ital. oftal. **9**:7-17, Jan.-Feb., 1956.

The author bases his reasoning on the current concepts of morphology, physiology, and clinical observation and stresses the importance of the eye in the vegetative process, so much so that he feels justified in speaking of "the vegetative eye." (7 figures)

V. Tabone.

Ruedemann, A. D., Jr. and Noell, W. K. **The effect of epinephrine upon the rabbit electroretinogram.** A.M.A. Arch. Ophth. **56**:100-108, July, 1956.

Epinephrine administered intravenously apparently affects the pigment epithelium of the retina to some degree in

the same fashion as illumination. Studies indicate that the mode of action is different. There is pigment migration due to a disturbance of the ionic equilibrium in the outer layers of the retina when the retina is subjected to illumination, but epinephrine has a direct effect. (5 figures, 7 references) G. S. Tyner.

Schirmer, R. **Chloramphenicol in external eye infections.** Klin. Monatsbl. f. Augenh. **129**:379-382, 1956.

720 patients were treated. Excellent results were obtained in bacterial infections while viral infections remained unchanged. Good local tolerance and an absence of toxic or allergic reactions were noted. (1 table, 17 references)
Frederick C. Blodi.

Schweer, G. **The hyaluronic acid content of the human vitreous.** Klin. Monatsbl. f. Augenh. **129**:317-319, 1956.

Glucosamine was measured in the vitreous of two enucleated eyes. The calculated hyaluronic acid value was nearly as high as the one found in cattle. The values reported in human eyes so far were much lower. (1 table, 5 references)
Frederick C. Blodi.

Selfa, Enrique. **Trypsin and heparin in ophthalmology.** Arch. Soc. oftal. hispanoam. **16**:525-532, May, 1956.

The pharmacology and the clinical application of these agents is reviewed, and the results of 19 cases in which trypsin was used are tabulated. The table shows excellent results in disciform keratitis and serpigenous ulcer of the cornea, no effect in retinal lesions and favorable effects in degenerative opacities of the cornea, thrombosis of a branch of the central retinal vein and uveitis. The anti-inflammatory action of trypsin is less than that of cortisone, and it should be used in cases in which there is coexistent infection. Heparin in a colirium of one to five percent is particularly indicated in cicatricial processes, surgical or accidental. (1 table, 6 references) Ray K. Daily.

Starkiewicz, W. and Giergielewiczowa, H. **Influence of cortical stimulation on the healing of eye burn in rabbits.** Klinika Oczna **26**:19-24, 1956.

Experiments were done on 30 rabbits in three groups. All of the rabbits had the cornea burned with 10 percent silver nitrate. One group of 10 served as controls. The other two groups were subjected to periodic sounding of an electric bell. One of them was given 2.0 gm. of sodium bromide daily. The healing of corneal burns was the fastest in the group given bromides and somewhat slower in the control group. The poorest healing was in the group subjected to the sound of the bell and given no sedatives. The results show that the cortical stimulation inhibits healing, and that bromides prevent the damaging effect of sound by increasing inhibitory and regulatory functions of the cortex. (2 figures, 1 table, 15 references)
Sylvan Brandon.

Tiong, Yap-Kie. **Protein deficiency in keratomalacia.** Brit. J. Ophth. **40**:502-503, Aug., 1956.

Measurements of serum protein in 10 patients with keratomalacia were compared with the findings in ten patients with xerophthalmia. A mean of 4.3 g/100 ml. was found in keratomalacia and 6.2 g/100 ml. in xerophthalmia. This small number of cases does not permit any conclusive deductions but does suggest a deficiency other than one of vitamin A. (1 table, 2 references)
Lawrence L. Garner.

Upholt, W. M., Quinby, G. E., Batchelor, G. S. and Thompson, J. P. **Visual effects accompanying TEPP-induced miosis.** A.M.A. Arch. Ophth. **56**:128-134, July, 1956.

An insecticide, tetraethylpyrophosphate (TEPP) used as a dust for spraying aircraft can produce miosis and lowered light and depth perception. In so doing the drug may be a potential hazard to the lives of flying personnel. (2 tables, 4 references) G. S. Tyner.

Wethmar, A. **The Influence of vasodilators on the retinal vessels.** Klin. Monatsbl. f. Augenh. **129**:231-252, 1956.

Numerous vasodilators were examined. Their effects were studied ophthalmoscopically by measuring the caliber of arterioles. Nitrites and nitrates showed a sharp, but short lasting vasodilation. Caffeine and theophylline cause a dilation of several hours' duration. A similar effect is obtained after the administration of papaverine, which is most effective when given intravenously. Priscoline causes a marked vasodilation not only of the arterioles but also of the veins, especially when given retrobulbarly. Acetylcholine and Doryl were effective for two to three hours. (20 figures, 1 table, 34 references) Frederick C. Blodi.

Willenz, A., Ballaceanu-Stolnici, C. and Brucar, I. **Experimental investigation of ocular interoceptors.** Klinika Oczna **26**: 1-18, 1956.

The authors used rabbits and cats in experiments designed to clarify the influence of ocular and cortical interoceptors on the stimulation of vegetative reflexes. One group of tests was arranged to test the influence of the ocular tension on the blood pressure and respiration of experimental animals. It was observed that the eye contains baroceptors which may stimulate vegetative reflexes. Increase of intraocular pressure acted differently from the pressure on the eye from outside. Changes in the pressure produced only a short-lasting effect on circulation or respiration, showing that they were only of a secondary nature. It also showed that increase in pressure stimulated vegetative reflexes in some cases and in others inhibited them. Experiments demonistrated that reflexes were transmitted through the nervous system and not through the changes in fluids. Another group of tests on decerebrate animals showed that the reflex arc passes through the brain stem. The afferent path of the reflex is the trigeminal nerve and the efferent path is the vagal nerve and the sympathetic system. (17 figures, 1 table) Sylvan Brandon.

Yumiyama, M. **The appearance of radioactive phosphorus (P^{32}) in the aqueous humor of rabbits after iridectomy. IV-V.** Acta Soc. Ophth. Japan **60**: 1328-1340, Sept., 1956.

An iridectomy causes a decrease in ocular tension for one month in rabbits. A simple impact to the root of the iris has the same effect. After either of these procedures the appearance of P^{32} in the aqueous is accelerated for one week when the agent is introduced intravenously. By iridectomy, the chamber angle is apt to be closed. Therefore, the effect of iridectomy for reducing ocular tension must be functional rather than mechanical. (2 figures, 42 references) Yukihiko Mitsui.

Zahn, K. and Simkova, M. **Effects of l-nor-adrenalin upon retinal circulation.** Ophthalmologica **131**:65-71, Jan., 1956.

l-nor-adrenalin was administered to ten individuals by slow intravenous drip in doses of about 10 γ per minute. The effect of the drug upon the retinal circulation was studied by measuring the systolic and diastolic arterial retinal pressure, the width of the angioscotomas and the ocular tension. The retinal arterial pressure was found to rise in close parallelism to the systemic blood pressure. At the same time the angioscotomas became smaller. These findings are interpreted as signs of improved retinal blood flow un-

der the influence of l-nor-adrenalin. (2 tables, 12 references)

Peter C. Kronfeld.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Crone, R. A. **Combined forms of congenital colour defects. A pedigree with atypical total colour blindness.** Brit. J. Ophth. **40**:462-472, Aug., 1956.

A pedigree of a Dutch family is given revealing combined forms of congenital color defects. The usual symptoms that are seen in the total colour blind are lacking in an occasional case of monochromatism. In this instance visual acuity is normal and photophobia and nystagmus are absent. The luminosity curve is a scotopic one and the ophthalmoscopic findings in the macula are normal. (6 figures, 1 table, 25 references)

Lawrence L. Garner.

ten Doeschate, G. and Kylstra, J. **The perception of parallels.** Ophthalmologica **131**:61-65, Jan., 1956.

An experiment is described in which the sensations of parallelism and convergence toward a vanishing point are in disagreement. In a large darkroom two iron pipes coated with fluorescent paint and illuminated by a source of ultraviolet light are placed objectively parallel, symmetrically with regard to the observer who is seated 1.4 meters from the near ends of the pipes with his eye-level one meter above them. His subjective sensation is that of two straight lines converging toward a vanishing point situated at eye-level on an imaginary line passing halfway between the pipes into space. The position of this vanishing point can be determined by making it coincide with a light spot projected onto a wall eight meters from the observers. A third parallel pipe placed one meter to the right or left of the right or left pipe is perceived as another parallel line, pointing, however, away from the vanishing point of the original two pipes. In order to obtain the sensation of a common vanishing point the third pipe has to be inclined toward the original pipes. This phenomenon, apparently at variance with the rules of central projection, may find its explanation in geometric or physiologic factors prevailing under the conditions of the experiment. (2 figures)

Peter C. Kronfeld.

Esente, Ivan. **Vision in premature infants and in the neonatal period in normal infants.** Gior. ital. oftal. **9**:38-73, Jan.-Feb., 1956.

In a very interesting article the author reports his studies on sensory and reflex activity in the different stages of prematurity as well as in the neonatal period of children born at term. He found that the eyes of premature infants have little functional use and show a retarded development of binocular vision and of reflexes connected with vision. Furthermore, eyes of premature infants keep the automatic reflexes longer, which disappear early in normal infants. (140 figures)

V. Tabone.

Falkowska, Zofia. **Anisopia and anisodomination.** Klinika Oczna **26**:25-34, 1956.

After citing the literature on anisopia and anisodomination the author describes her observations of the Pulfrich phenomenon. She found that the magnitude of the stereopic effect depends on the type of eye dominance. Methods of quantitative tests for anisopia are described. The author feels that the changes in the tonus of the eye are responsible for these phenomena. The tonus of the eye is regulated through the parasympathetic and sympathetic innervations and is affected by the stimuli from the cortex and originating in the macula. The dominant eye

being under more efficient control of the cortex has a different vegetative tonus. Darkness myopia also has a similar mechanism, being the result of the stimulation of the vegetative system. (8 figures, 25 references) Sylvan Brandon.

Kestenbaum, A. and Sturman, R. M. **Reading glasses for patients with very poor vision.** A.M.A. Arch. Ophth. **56**: 451-470, Sept., 1956.

This timely and complete outline of the various forms of visual aids for patients with very subnormal vision will be of great help to that fortunately increasing number of oculists who are becoming interested in this extremely important phase of ophthalmology. (6 figures, 1 table, 4 references) G. S. Tyner.

Maitani, M. **Changes in the corneal curvature and refraction following a lamellar scleral resection.** Acta Soc. Ophth. Japan **60**:1168-1180, Aug., 1956.

A hyperopia and astigmatism result from lamellar resection of the sclera in rabbits. The reduction in the refractive power averages 1.33 diopters in the meridian passing the middle of the resection and 2.06 diopters in the perpendicular meridian when a segment of sclera which measures about 10 × 4 mm. is removed along the equator of rabbits eyes. (10 figures, 11 tables, 23 references) Yukihiko Mitsui.

Perez Llorca, J. **Is myopia ever a surgical indication?** Arch. Soc. oftal. hispano-am. **16**:419-422, March-April, 1956.

The author disparages all surgery for myopia as ineffective in arresting myopic changes at the posterior pole, and productive of unjustifiable ocular trauma. Ray K. Daily.

Sapuppo, C. **Light sensitivity and photopic sensitivity.** Gior. ital. oftal. **9**:79-88, Jan.-Feb., 1956.

Experiments on ten subjects showed that light exposure of one eye produced an elevation of the light sensitivity threshold in the other eye which had been kept in the dark for 30 minutes. The possible mechanisms of such "reflex action" are discussed. (1 chart, 6 figures) V. Tabone.

Schirmer, R. **Cyanopsia and medullated nerve fibers.** Klin. Monatsbl. f. Augenh. **129**:261-262, 1956.

A ten-year-old boy said that as long as he could remember everything looked blue for various periods of time—and this occurred several times daily, sometimes less often. Both discs were covered with extensive myelinated nerve fibers. (3 references) Frederick C. Blodi.

Tiberi, Gian Francesco. **Effect of ametropia on the autokinetic phenomenon of the luminous point.** Gior. ital. oftal. **9**: 118-132, Jan.-Feb., 1956.

The psychologic and kinetic theories of the phenomenon are amply discussed. The results of autokinetic tests on emmetropic and ametropic subjects seemed to confirm the kinetic hypothesis of the apparent movement of fixed objects, held by Rubino and Santarelli. The autokinetic phenomenon of the luminous point (Charpentier 1886) is the illusion of movement of a fixed luminous point in complete darkness. (5 figures, 3 tables, 5 references) V. Tabone.

5

DIAGNOSIS AND THERAPY

Badtke, Gunther. **A special form of pseudoglioma.** Arch. Soc. oftal. hispano-am. **16**:328-342, March-April, 1956.

The classifications of pseudoglioma are discussed and a case described in detail, with histopathologic findings. The left eye of a one-and-one-half-year old infant was enucleated with the diagnosis of an

intraocular glioma. The genesis of the pseudoglioma is discussed on the basis of the histologic findings. (3 microphotographs, 40 references) Ray K. Daily.

Bamford, C. H. **Anaesthetics and relaxants in ophthalmic surgery.** Tr. Ophth. Soc. U. Kingdom **75**:599-603, 1955.

The author used curare combined with retrobulbar injection for cataract extraction for two years in 88 patients. Two patients caused him great anxiety and he does not propose to use it again.

Beulah Cushman.

Böhringer, H. R. **The local therapy with newer cortisone derivatives and cortisone combinations.** Klin. Monatsbl. f. Augenh. **129**:265-266, 1956.

Hydrocortisone was found superior to cortisone in the treatment of vernal catarrh. Fluorhydrocortisone was of advantage in resistent cases. Cortisone-antibiotic combinations were used successfully in corneal ulcers. (3 references)

Frederick C. Blodi.

Burmeister, Heinrich. **Microwave irradiation of the eye.** Klin. Monatsbl. f. Augenh. **129**:336-342, 1956.

This treatment was especially helpful in patients with iritis and iridocyclitis (36), lens matter in the chamber (8) and retrobulbar neuritis. (31 references)

Frederick C. Blodi.

Burn, R. A. **Anaesthetics and relaxants in ophthalmic surgery.** Tr. Ophth. Soc. U. Kingdom **75**:595-597, 1955.

The author used a combination of chlorpromazine, phenergan and pethidine by intravenous and intramuscular injection and compared the results with the standard method of barbiturate sedation. He found it satisfactory for intra-ocular operations but not for squint operations, but it does increase the need for effective local anesthesia and akinesia. (1 table)

Beulah Cushman.

Cridland, Nigel. **Anaesthetics and relaxants in ophthalmic surgery.** Tr. Ophth. Soc. U. Kingdom **75**:563-573, 1955.

The author discusses the use of general anesthesia in eye surgery in 161 patients and found it more advantageous than analgesia. The patient's anxiety was removed, the surgeon's mind could be concentrated upon the operation with more leisured tempo of operation; and there was an advantageous absence of swelling of the lids and of proptosis during the operation as well as thereafter. (2 figures, 2 tables, 1 reference)

Beulah Cushman.

Del Buon, Gilberto. **A case of bilateral metastatic ophthalmia cured by antibiotics.** Gior. ital. oftal. **9**:217-222, Jan.-Feb., 1956.

A woman, 52 years of age, with bronchiectasis and bilateral metastatic ophthalmia was cured with intensive antibiotic therapy with terramycin, achromycin and penicillin. Cortisone was also used. (17 references) V. Tabone.

Ellis, O. H. and Levy, O. R. **A new magnetic orbital implant.** A.M.A. Arch. Ophth. **56**:352-360, Sept., 1956.

The authors present a new magnetic orbital implant which has a ring anteriorly and a cone posteriorly, combined with a strong magnet which is placed well forward in the implant. Excellent results have been experienced so far but there is a possibility that, because of the strong magnet, erosion of the conjunctiva may occur. There is an excellent discussion of the problem of buried implants. (9 figures, 5 references) G. S. Tyner.

Greaves, D. P. **The effect of retrobulbar anaesthesia on intraocular pressure.** Tr.

Ophth. Soc. U. Kingdom **75**:121-135, 1955.

Experimental and clinical results show that a retrobulbar anesthetic produces a change in the intraocular pressure by its action on vessels in addition to that caused by an alteration in extraocular muscle tone. The addition of adrenaline to the anesthetic appears to cause a greater depression of tension. Hyaluronidase offered no special advantage. (3 figures, 4 tables, 15 references)

Beulah Cushman.

Ham, Harold. **Radiotherapy in diseases of the eye.** Tr. Ophth. Soc. Australia **15**: 101-109, 1955.

A plea is made for team work between the eye surgeon and the radiotherapist. Beta radiation is used for nonmalignant superficial lesions. The treatments of epithelioma of the limbus, malignant melanoma, carcinoma metastases and retinoblastoma are discussed. (1 table, 7 references)

Ronald F. Lowe.

Healy, J. J. **Anaesthetics and relaxants in ophthalmic surgery.** Tr. Ophth. Soc. U. Kingdom **75**:591-594, 1955.

Local anesthesia has always been favored for ophthalmic surgery and to achieve satisfactory provisions the patient must be informed meticulously as to the nature of the operation, the pre- and post-operative procedures. The nursing care must be intelligent, there must be full examination of the cardiovascular condition, and adequate sedation and reduction of apprehension by use of seconal or similar products. It is necessary to maintain control of the patient's apprehension without too much soporific effect.

Anesthesia is produced by 4 percent cocaine solution instilled before the patient leaves the room and again in the operating room; then novocaine solution (2 percent) is injected into the areas supplied by branches of the fifth nerve as well as between the inferior and lateral rectus muscles and along the side of the superior rectus. Akinesia is accomplished by nerve block of the facial nerve. Tubocurarine is to be used as necessary for relaxation and dramamine also is used as indicated. (1 table) Beulah Cushman.

Hertzog, Francis C. **Absorption of Boeck's sarcoid iris nodule with systemic prednisone.** A.M.A. Arch. Ophth. **56**: 135-137, July, 1956.

The author describes the dramatic regression of both ocular and systemic signs of sarcoidosis in a 24-year-old negro after two weeks of treatment with high doses of prednisone (35 mg. daily). (2 figures, 3 references) G. S. Tyner.

Inman, W. S. **Emotional factors in eye disease.** Tr. Ophth. Soc. U. Kingdom **75**:685-689, 1955.

The author cites many interesting eye problems from glaucoma to styes which seem to have been precipitated by mental stress. He feels that really happy, carefree persons do not get glaucoma or "tonic" pupils and that unrelieved morbid anxiety is a bad bedfellow. He noted a proneness to acne vulgaris and styes in adolescence, that phase of life so vulnerable to conflicts attached to secondary sexual development. (15 references)

Beulah Cushman.

Jakov, M. **The role of foci of pathologic irritation of the dental nervous system in eye diseases.** Vestnik oftal. **4**:38-39, July-Aug., 1956.

Clinical observations on more than 100 patients established the fact that functional disturbances in various organs were caused by reflex irritation, from microbic or chemical foci, of the nerves of the devitalized pulp of the teeth, or of dead teeth having fillings or gold crowns.

Aside of minor disturbances of the

eyes, there were also recurrent keratitis and uveitis which responded to no treatment. The extraction of devitalized teeth brought prompt improvement.

Olga Sitchevska.

Jendralski, Hans-Joachim. **Experiences with Ircodenyl after eye operations.** Klin. Monatsbl. f. Augenh. **129**:263-264, 1956.

Ircodenyl is a combination of butazolidin, a pyrazonlon derivative, codeine and a barbiturate. It was given as a suppository after 86 eye operations of all kinds. It sedates the patient, induces sleep, prevents cough and alleviates pain. (10 references) Frederick C. Blodi.

Kawahigashi, A. **Ophthalmic test for prevention of penicillin anaphylaxis.** Acta Soc. Ophth. Japan **60**:1181-1202, Aug., 1956.

An instillation of penicillin solution (1,000 U/ml) in the eye prior to an injection of this agent is valuable for the prevention of penicillin-shock. In allergic persons a rapid ocular reaction results. If a definite conjunctival hyperemia appears in ten minutes after the instillation, an injection of penicillin should not be given. (12 figures, 10 tables, 40 references) Yukihiko Mitsui.

Kleberger, E. **The use of cortisone and hydrocortisone in ophthalmology.** Klin. Monatsbl. f. Augenh. **129**:349-358, 1956.

Of the 120 patients in whom these drugs were applied topically, the best results were obtained in patients with follicular conjunctivitis, episcleritis, epidemic keratoconjunctivitis, interstitial and disciform keratitis, acute iridocyclitis and Mooren's ulcer. (2 tables, 61 references) Frederick C. Blodi.

Lodato, Giuseppe. **Retinal tonoscopy in obstetrics and gynecology.** Gior. ital. oftal. **9**:95-99, Jan.-Feb., 1956.

The author stresses the importance of this procedure. (9 references)

V. Tabone.

Manna, Feliks. **Mechanism of action of typhoid vaccine in eye diseases on the basis of white cell examination.** Klinika Oczna **26**:35-45, 1956.

In 40 patients, most of whom had uveitis or wounds of the eye, typhoid vaccine was used for treatment and the blood was collected from patients at different phases of reaction to the vaccine. The number of leucocytes increased when the temperature rose, whereas the lymphocytes and eosinophiles decreased. When the temperature returned to normal the leucocytes decreased in number and lymphocytes, eosinophiles and monocytes increased. To facilitate analysis of material the author used an index which he obtained by dividing the number of leucocytes by the number of lymphocytes and eosinophiles. The index was higher when the fever rose and particularly in the group in which the temperature rose above 39° C. The behavior of the white cells resembled the reaction to injection of ACTH and was characteristic of the adaptation syndrome of Selye. It reflected the action of the typhoid vaccine on the pituitary and the adrenal cortex system. The relation of monocytes to lymphocytes reflected the degree of stimulation of the reticulo-endothelial system and also the effectiveness of treatment with the typhoid vaccine. The vaccine was effective in acute and also chronic, but active, cases of uveitis. It helps in early cases of eye wounds but should not be used in tuberculosis of the eye. (3 figures, 1 table, 23 references) Sylvan Brandon.

Miller, H. A. and Audoueineix, D. **Diastolic retinal pressure. Its value and significance in vascular hypertension.** Tr. Ophth. Soc. U. Kingdom **75**:391-403, 1955.

The authors have linked the retinal anatomical facts with information given by vascular dynamic studies in the assessment of arterial hypertension in relation to the application of therapeutics. Benign hypertension in which humeral diastolic tension is low, the renal function good, the E.C.G. normal, the tension responds to ordinary diet and biopsy shows abnormality of the media only, without endarteritis, develops near the age of 60 years. Potential malignant hypertension, after a period of benign disease, develops a malignant state with remnants of a degree of lability under the influence of therapy. Biopsy shows lesions of both media and intima. The retinal tension of variations under various treatments are detected much earlier and more easily than alterations of arteriolar caliber, extent of exudates or the number of hemorrhages. (6 figures, 2 tables)

Beulah Cushman.

Nutt, A. B. **Anaesthetics and relaxants in ophthalmic surgery.** Tr. Ophth. Soc. U. Kingdom **75**:581-585, 1955.

Intravenous largactil in intra-ocular surgery has been followed by remarkably few complications. The patients were as immobile as under general anesthesia and there was no need for hurry during the operation. The eyes were very soft. Of 100 patients three experienced a minor degree of nausea and vomiting. In six of 83 cataract operations the capsule ruptured, vitreous presented in two, post-operative hyphema occurred in one, in two patients iris prolapse was found at the first dressing and there was spontaneous hemorrhage into the vitreous in a diabetic on the eighth day. (6 references)

Beulah Cushman.

Ohm, J. **Optokinetic and optostatic reactions in children.** Klin. Monatsbl. f. Augenh. **129**:255-258, 1956.

The author examined his four grandchildren with his method to determine visual acuity objectively. This test can be applied in cooperative children. (2 tables) Frederick C. Blodi.

Rizzini, V. **Plethismography in glaucoma.** Gior. ital. oftal. **9**:100-108, Jan.-Feb., 1956.

In a group of glaucomatous patients, arteriolar changes were always found by plethismography. The importance and the interpretation of these findings are discussed. (9 figures, 14 references)

V. Tabone.

Sandiford, H. B. C. **Anaesthetics and relaxants in ophthalmic surgery.** Tr. Ophth. Soc. U. Kingdom **75**:575-580, 1955.

Highly specialized surgery requires operative conditions, which the anesthetist only can provide, with a more positive control of the plane of anesthesia and of respiration. Premedication is important and tipping the table helps to produce a bloodless field. Close cooperation between the eye surgeon and the anesthetist is necessary to achieve the desired results. (3 references) Beulah Cushman.

Schwickerath, Meyer. **Coagulation of the fundus and iris with light. A new method of treatment.** Arch. Soc. oftal. hispano-am. **16**:363-376, March-April, 1956.

This is a description of the author's apparatus and technique for coagulation of retinal tears and other pathologic processes in the fundus by means of intense light. Based on an experience in 160 cases, the author sees the advantages of this operation in its simplicity, the possibility of its performance under direct ophthalmoscopic observation and exact localization, its safety and the ease of repetition. This operation is effective only in cases in which the retina is but slightly separated from the choroid. The operation was successful in arresting the recurrent

hemorrhages in six cases of retinal periphlebitis. The procedure is also useful in the prevention of post-traumatic retinal detachment in perforating ocular injuries. Small macular tumors were successfully destroyed without diminishing the visual acuity. The operation is suitable for producing an artificial pupil without opening the globe in postoperative pupillary occlusion. (7 figures) Ray K. Daily.

Stallard, H. B. **The use of air in eye surgery.** Tr. Ophth. Soc. U. Kingdom **75**: 33-41, 1955.

Air from an elastic, readily compressible cushion is absorbed slowly; for use it can be drawn through a cotton filter, spirit flame or through heated needles. Air can be used after cataract operations to separate the iris and vitreous face, to restore a collapsed cornea, to reform the anterior chamber. In glaucoma the author uses an air bubble at the end of a trephine operation under the conjunctival flap, and a subconjunctival injection of air around the site of the fistula. After a cyclodialysis operation an air bubble checks hyphema, it widens the intraocular fistulous track and keeps it open, and helps to reform the anterior chamber. In retinal detachment the use of air aids in the drainage of the interretinal fluid. Air is also used at the end of a corneal graft operation to restore the anterior chamber to prevent anterior synechia. (13 references)

Beulah Cushman.

Stanworth, A. **Modifications in surface diathermy operations.** Tr. Ophth. Soc. U. Kingdom **75**:379-390, 1955.

The author describes a pyrometric electrode which incorporates a thermocouple which measures the temperature at the point of application. Coppez (1935) was the first to describe such an electrode but the author kept the diathermy circuit separated from the thermocouple circuit to avoid inaccuracy in temperature recording. The scarring bears a definite relationship to the temperature and to a reaction of particularly even appearance. This electrode also produces a predictable reaction in cyclodiathermy operations for glaucoma. (3 figures, 1 table, 1 reference)

Beulah Cushman.

Stanworth, A. and Naylor, E. J. **The measurement and clinical significance of the Haidinger effect.** Tr. Ophth. Soc. U. Kingdom **75**:67-79, 1955.

The Haidinger effect depends upon a pigmented substance with a maximum absorption in the spectra at 425, 455 and 485 m. It forms the basis of a simple and rapid test for macular edema; it may help in the prognosis of macular degenerations without obvious edema. The test may be of value in myopia, nuclear cataracts and in secondary cataracts. Keratoconus may interfere with the effect, as may glaucoma and amblyopia. (6 figures, 8 references)

Beulah Cushman.

Swan, K. C., Crisman, H. R. and Bailey, P. F., Jr. **Subepithelial versus subcapsular injections of drugs.** A.M.A. Arch. Ophth. **56**:26-33, July, 1956.

As might be expected, drugs injected beneath Tenon's capsule are more effectively absorbed than those merely injected beneath the conjunctival epithelium. (9 figures, 2 references)

G. S. Tyner.

Victorova, V. **The treatment of tuberculosis of the eye with Ftivazide.** Vestnik oftal. **4**:21-25, July-Aug., 1956.

The study of a new anti-tuberculous remedy is being made at the eye clinic of the 1st Moscow Medical Institute. Ftivazide is a hydrozide of isonicotinic acid. An experimental study showed that Ftivazide possesses a high antituberculous activity. It enters the blood from the

gastrointestinal tract, stays in the blood for a long time in high concentration, and has very little toxicity. It was used in 26 patients with tuberculosis of the eye; 16 had keratitis, scleritis and anterior uveitis, seven had a posterior uveitis, and three a combination of both. No other antibiotics were given during the treatment, unless the effect was insufficient; then streptomycin was added. The dose was 0.5 gm. twice daily; in all, from 30 to 80 grams. In eight patients, there were old advanced changes in the choroid and retina and organized opacities in the vitreous. In 18 patients, the lesions were fresh in the fundus with fresh opacities and vascularization of the cornea. In 18 patients the treatment was effective, particularly in those with the diseased anterior segment of the eye. Reduction of edema of the macula and absorption of exudates which led to increased visual acuity was also noted. The general condition of the patients was also improved. The intradermal Mantoux reaction was increased which speaks for the higher resistance to the organism. The time of observation was from six to eight months.

The advantage of the use of Ftivazide is its fast absorption, the near absence of side effects, the elimination of injections and its established bacteriostatic action on the tubercle bacilli. (1 table)

Olga Sitchevska.

Wilson, H. L. **Anaesthetics and relaxants in ophthalmic surgery.** Tr. Ophth. Soc. U. Kingdom **75**:587-589, 1955.

The author describes the results of using chlorpromazine hydrochloride in 100 patients, of which the majority came for cataract extraction, glaucoma surgery and corneal grafting. Three patients vomited three to four hours after the operation, one patient recovered from a pulmonary embolus on the fourth post-operative day and one patient developed iris prolapse.

Beulah Cushman.

6

OCULAR MOTILITY

Bean, William Bennet. **Ophthalmoplegia, steatorrhea, phlebectasia, and vascular lipomas.** Arch. Int. Med. **98**:284-287, Sept., 1956.

Bean reports the salient features of a man who had steatorrhea, Wernicke's syndrome, phlebectasis and vascular lipomas. He suggests that this may possibly represent a new syndrome. (6 figures)

Irwin E. Gaynon.

Jaensch, P. A. **Convergent strabismus in myopes.** Arch. Soc. oftal. hispano-am. **16**:318-324, March-April, 1956.

After a brief reference to the literature on acute strabismus in myopic adults, the author reports in detail a case of a woman with high myopia, who developed convergent strabismus and an annoying diplopia when she was 20 years of age. For 15 years the patient wore a correction on the right eye only, with a plano lens or an occluder on the left eye to avoid diplopia. She was found to have strabismus of 40 degrees, with a variable fusion amplitude, an excessive adduction, and a marked weakness of abduction. The author attributes the fusion instability to the prolonged occlusion of the left eye. Within the next two years the patient was subjected to a series of operations, which included a tenotomy of the right medial rectus, a bilateral recession of the medial recti, a resection and advancement of the right lateral rectus, and a repetition of the recession of the right medial rectus. On exposure the medial recti were found inelastic and fibrotic; the author attributes this degenerated condition of the muscles to the long-standing strabismus. The right lateral rectus was found attached 9 mm. behind the limbus, which indicates that the myopic axial elongation of the eyeball involved the anterior as well as the posterior portion of the globe.

After the last operation, decentration of the lenses permitted the patient to maintain fusion. (3 figures, 6 references)

Ray K. Daily.

Parks, Marshall M. **Strabismus.** A.M.A. Arch. Ophth. **56**:138-159, July, 1956.

The pertinent literature for the year is abstracted and reviewed. (159 references)

G. S. Tyner.

Reusch, Ernst. **Active and passive sensory orthoptics.** Klin. Monatsbl. f. Augenh. **129**:382-392, 1956.

For occlusion the author advises an opaque clip-on worn back of the spectacle lens. Occlusion is also important after the operation to avoid abnormal retinal correspondence. The after-image test is used. It is possible that the separated bars of the cross become united when the room light is repeatedly switched on and off (Dollberg). This effect can also be used therapeutically when targets are brightly illuminated and alternatingly exposed when the arcs are set at the positive angle. (3 figures, 12 references)

Frederick C. Blodi.

Ruedemann, Albert D., Jr. **Scoliosis and vertical ocular muscle imbalance.** A.M.A. Arch. Ophth. **56**:389-414, Sept., 1956.

Eleven cases are reported to illustrate the spinal scoliosis which is produced when there is weakness from birth of any one or pair of vertically acting muscles, causing excessive cyclorotation of the eye. Neutralization of this defect is necessary for ocular rotational parallelism. This results in "ocular torticollis" and compensatory scoliosis. Superior oblique-superior rectus involvement is commonest. No bony abnormality is found. The maintenance of fusion is not necessary in order for the scoliosis to persist. The concept is made very clear by 18 X-ray films and particularly by seven diagrams. (18 figures, 7 diagrams, 7 references)

G. W. Tyner.

Velhagen, Carl. **General remarks on strabismus.** Arch. Soc. oftal. hispano-am. **16**:325-327, March-April, 1956.

Velhagen advocates early refractive, orthoptic and pleoptic treatment of strabismus; surgery, if indicated, is performed before the child goes to school. He prefers bilateral surgery to avoid inequalities in the two palpebral fissures, and is a partisan of tenotomy of the internal rectus. He points out that strabismus has a strong hereditary etiologic factor, and urges that children in a family with strabismus have early examinations of their refraction and binocular function.

Ray K. Daily.

7

CONJUNCTIVA, CORNEA, SCLERA

Armstrong, K. and McGovern, V. J. **Scleromalacia perforans with repair grafting.** Tr. Ophth. Soc. Australia **15**:110-121, 1955.

This interesting case report illustrates and describes the histology of scleromalacia perforans, with accompanying rheumatoid arthritis. The features in the joints and in the sclera are essentially the same; namely, necrosis of collagen surrounded by histiocytes. Granulation tissue of poor quality is present. The eyes were in danger of perforation but grafts of fascia lata were incorporated into the episcleral tissues adequately supporting the degenerate sclera. Specimens for histological reports were obtained at autopsy. (15 figures)

Ronald F. Lowe.

Azzolini, U. **Lysozyme in herpetic keratitis.** Gior. ital. oftal. **9**:32-37, Jan.-Feb., 1956.

Favorable results are reported from the use of lysozyme in herpetic corneal infections, particularly dendritic ulcers and vesicular keratitis. (6 references)

V. Tabone.

Barraquer Moner, Jose I. **The continuous edge-to-edge suture in full-thickness corneal grafts.** A.M.A. Arch. Ophth. **56**: 426-428, Sept., 1956.

The author favors the continuous suture and for the inevitable discomfort associated with corneal sutures he recommends retrobulbar injection of 10 to 20 percent alcohol. (1 figure, 5 references)

G. S. Tyner.

Bhaduri, B. N. and Basu, S. K. **Scleral gumma.** Brit. J. Ophth. **40**:504-506, Aug., 1956.

A case report of an isolated gumma of the sclera, adjacent to the limbus and without invading the ciliary body, is presented. Spontaneous perforation resulted and was followed by complete healing and recovery after antisyphilitic therapy. Wassermann and Kahn tests were positive. (1 figure, 4 references)

Lawrence L. Garner.

Constantinovits, Milan. **Erythromycin in the treatment of trachoma.** Klin. Monatsbl. f. Augenh. **129**:343-348, 1956.

Fifty-seven patients were treated with the ¼ percent ointment. In 22 patients only one eye was treated with erythromycin, the other terramycin. The conjunctiva became sterile in three days and the inclusion bodies disappeared after one more day. The effect of erythromycin is comparable to that of terramycin. The treatment has to be of long duration to ensure a complete cure. (8 references)

Frederick C. Blodi.

D'Amato, Aldo. **Research on corneal sensitivity.** Gior. ital. oftal. **9**:223-234, Jan.-Feb., 1956.

A study of corneal sensitivity was made in normal eyes, in eyes the seat of certain diseases, and after instillation or subconjunctival injection of certain drugs. The following drugs lowered corneal sensitivity in decreasing order: carbachol, mintacol, eserin, dionin, antadril and antistinprivin. Corneal sensitivity was equally diminished in the following ocular conditions: spring catarrh, phlyctenular keratoconjunctivitis, pterygium, herpetic keratitis, disciform keratitis, ophthalmic herpes zoster, corneal leucomas, trachoma, glaucoma, and soon after corneal surgery. (6 figures, 31 references)

V. Tabone.

Foster, James B. **The post-operative management of corneal grafts.** Tr. Ophth. Soc. Australia **15**:167-170, 1955.

A detailed description of careful nursing and the antihistaminics, cortisone and radiotherapy is presented.

Ronald F. Lowe.

Giardini, A. and Cambiaggi, A. **The thickness of the cornea after cataract extraction.** Ophthalmologica **131**:41-50, Jan., 1956.

With the attachment to the Haag-Streit slitlamp devised by Maurice and Giardini (cfr. Am. J. Ophth. 34:1199, 1951) the present authors measured the changes in corneal thickness that follow cataract extraction. The center of the cornea was thought to best represent the overall changes. Its thickness was measured, in 37 cases, before and every few days after surgery. In a good many cases reliable measurements were obtained on the third postoperative day. The mean change for the whole group was an increase in thickness of about 50 percent during the first five days after surgery. This swelling subsided within 30 to 45 days. By concurrent slitlamp examinations the authors found the thickening more pronounced in the upper segment than in the center of the cornea. The change in thickness from above down took place gradually in some cases and abruptly in others. (1 figure, 2 graphs, 20 references)

Peter C. Kronfeld.

Greer, C. H. **Pigmented tumors of the conjunctiva.** Tr. Ophth. Soc. Australia 15:128-143, 1955.

The pigmented tumors are classified as benign, precancerous and malignant (with subdivisions in each group). The histologic characters of each are defined in an attempt to clarify the confused terminology in current use and to relate conjunctival pigmented tumors with those occurring in other parts of the body. Exact diagnosis is essential for rational treatment. Repeated observations aided by serial photographs under standard conditions may be necessary to detect early malignant change in a pigmented tumor. (15 figures, 2 tables, 9 references)

Ronald F. Lowe.

Günther, G. **Partial necrosis of the graft in keratoplasty.** Arch. Soc. oftal. hispano-am. 16:355-362, March-April, 1956.

Günther reports two cases of penetrating keratoplasty with the rare complication of partial necrosis of the graft. Both operations were done as a curative procedure for corneal ulcers. The necrotic portion, which was free of vessels and denuded of epithelium, tended to eliminate itself in the manner of a sequestrum, which was separated from the healthy tissue by a zone of leukocytic infiltration. The rest of the graft remained healthy. The grafts were fixed by direct primary sutures in one case, and in the other case the direct sutures were inserted three weeks postoperatively at a secondary operation for repair. The postoperative course was similar in both cases. The tissue of the graft within the sutures became swollen, and a necrotic area appeared; in the course of several weeks, it became sharply circumscribed from the healthy portion of the graft which became vascularized. The necrotic portion was free of vessels, and lost its epithelium, which did not regenerate. Histologically, the necrotic area consisted of a mass of fibers with intermediate cavities filled with an amorphous mass, presenting a picture similar to a developing cataract. The necrotic section was demarcated from healthy tissue by a zone of leukocytic infiltration. Medical therapy was ineffective, and the necrotic section was excised in one case, and the operation was repeated in the other case. The author attributes the complication to defective donor corneas. (4 microphotographs, 1 reference)

Ray K. Daily.

Irvine, A. Ray, Jr. **The role of the endothelium in bullous keratopathy.** A.M.A. Arch. Ophth. 56:338-351, Sept., 1956.

Bullous keratopathy is a state of abnormal corneal epithelial hydration with corneal opacification and epithelial vacuoles and bullae. The author believes that the condition is started by changes in the corneal epithelium, usually a decrease in number of endothelial cells. The concentration of the cells varies even in normal corneas, however. Nine cases are cited to illustrate the views expressed. (12 figures, 3 charts, 3 tables, 3 references)

G. S. Tyner.

Leigh, A. G. **Keratoplasty in cases of gross corneal opacification.** Tr. Ophth. Soc. U. Kingdom 75:523-529, 1955.

The author presents the steps necessary in patients with gross opacification of the cornea. He feels that for a graft to survive it must be placed in contact with tissue which has recognizable corneal structure and in which the opacification does not exceed two-thirds of the area and thickness of the cornea. The operation is carried out in two stages; the first is performed by placing a lamellar graft 6 mm. in diameter in a bed of similar dimensions in the central area. Centration is obtained by free-hand marking of the opaque cornea. After a variable period (up to six or nine months) sensitivity develops in the

graft and annular grafting may then be performed. A concentric ring is cut with a 7 mm. trephine and an annular graft is placed. The annular graft usually remains clear. When corneal sensitivity has returned then a final 5.0 mm. perforating graft may be performed. He emphasizes that the final perforating graft must not be attempted unless the central lamellar and annular grafts are relatively clear. If opacification occurs in either or both grafts he repeats this step with such necessary modifications as to position and size as befit the individual patient.

Beulah Cushman.

Macindoe, N. M. **Lamellar grafting.** Tr. Ophth. Soc. Australia **15**:171-174, 1955.

Macindoe very briefly summarizes the indications, technique, prognosis, failures and successes in lamellar corneal grafting. Ronald F. Lowe.

Oppel, O. **The etiology of vernal catarrh.** Klin. Monatsbl. f. Augenh. **129**: 365-371, 1956.

A pair of twins with vernal catarrh was observed. The author speculates on the effect of an atmospheric dust pollution on a neural allergic dysregulation. (3 figures, 6 references.

Frederick C. Blodi.

Quinn, C. A. and Crookes, G. P. **Bilateral band-shaped keratopathy associated with endogenous uveitis and rheumatoid arthritis. Treatment with E.D.T.A.** Tr. Ophth. Soc. U. Kingdom **75**:705-707, 1955.

The authors report the satisfactory result of treatment of bilateral band-shaped keratopathy in a woman, 45 years of age, with curettage of the epithelium over the opacity in the right cornea, followed by continuous irrigation with warmed neutral disodium ethylenediamine-tetraacetic acid solution for 20 minutes. The left eye was treated four days later and five days later each cornea was clear. (3 references) Beulah Cushman.

Ridley, Frederick. **Contact lenses in treatment of keratoconus.** Brit. J. Ophth. **40**:295-304, May, 1956.

Between April, 1951 and September, 1955 more than 2,000 patients were seen in the Contact Lens Department of the Royal Westminster branch of Moorfields, Westminster and Central Eye Hospital, London and 92 of these were seen with a diagnosis of keratoconus. Most came because their vision could not be adequately improved by spectacles. Ten patients showed residual lenticonus. The cases were evenly distributed as to sex, age or right and left eye, although almost all are or become bilateral. The disease usually begins to appear at the age of ten years, reaches its peak at 16 and rarely changes beyond 27 years of age. The first eye is usually much more severe than the second and the change is usually about two years older in the first than in the second. Of the 92 cases, 9 were found unsuitable for contact lenses and of the 83 remaining, 34 had had their lenses for more than 12 months. Almost any eye with vision of not less than finger counting at one foot could be improved. In this series, all lenses were made by molding. Conical corneas were fitted with the same facility and ease as normal ones and results were generally very satisfactory. Improvement to useful or normal vision was immediate and lasting in most cases and iseikonia and binocular vision was the rule. In only one case did the cornea continue to deteriorate after the fitting and wearing of contact lenses and it seems probable that the wearing of the lenses does arrest the progress of the disease. (8 figures, 1 reference) Morris Kaplan.

Roberts, W. H. and Wolter, J. R. **Ocular chrysiasis.** A.M.A. Arch. Ophth. **56**:48-52, July, 1956.

The authors describe a patient in whom gold was deposited in the ocular tissue after treatment of arthritis by intramuscular injection of gold salts. The material was apparently well tolerated and was extruded by way of the conjunctiva. (8 figures, 11 references) G. S. Tyner.

Rouher, F. and Tronche, P. **Use of delta-cortisone in ophthalmology.** Press Med. **64**:1395-1396, Aug. 11, 1956.

In this study the authors employed a local preparation of delta-cortisone (prednisone) of which they instilled a 0.25 percent suspension into the conjunctival culde-sac every two hours in severe cases and three times a day in mild cases. A total of 129 cases is reported and the results are tabulated by clinical entities. As has been reported in other studies, the best response is obtained in cases of acute iritis (postoperative and nonspecific) and allergic keratoconjunctivitis. They also report 7 of 11 patients with viral keratitis improved. This is not in accord with the findings of Thygeson, Kimura and others in this country who have been plagued by the problem of metaherpetic keratitis initiated or aggravated by the use of cortisone preparations in cases of dendritic keratitis. David Shoch.

Suie, T. and Taylor, F. W. **The effect of cortisone on experimental pseudomonas corneal ulcers.** A.M.A. Arch. Ophth. **56**:53-56, July, 1956.

Cortisone with an effective antibiotic may adversely affect the course of experimentally produced pseudomonas corneal ulcers. (2 figures, 3 tables, 4 references) G. S. Tyner.

Thygeson, P., Kimura, S. J. and Hogan, M. J. **Observations on herpetic keratitis and keratoconjunctivitis.** A.M.A. Arch. Ophth. **56**:375-388, Sept., 1956.

The authors thoroughly discuss these entities from many angles and conclude that herpetic keratitis is now the most important corneal disease leading to loss of vision in the United States and that present therapy and prophylaxis are deficient. The deleterious influence of cortisone and related steroids is stressed and their use deprecated. (3 figures, 1 table, 8 references) G. S. Tyner.

Tudor Thomas, J. W. **Technique and results in keratoplasty.** Tr. Ophth. Soc. U. Kingdom. **75**:473-513, 1955.

The author reviews the results obtained during the years 1922-53 in the development of keratoplasty and the relation of the results to changes in technique and to a favorable condition of the eyes. The use of an acrylic corneal implant with a lamellar corneal transplant in five cases is presented. (1 figure, 17 tables, 28 references) Beulah Cushman.

Winning, James. **Epidemic kerato-conjunctivitis in the Clydeside area.** Brit. J. Ophth. **40**:509, Aug., 1956.

An outbreak of epidemic kerato-conjunctivitis is at the present time running its course and 700 cases have been diagnosed. The majority of cases occurred in workers in the shipyards or engineering shops. Members of the same family were rarely affected although several cases of cross-infection in the hospital were noted. Clinically the condition appears as a follicular conjunctivitis with preauricular adenitis. Superficial punctate keratitis occurred in most cases and in some patients nummular interstitial opacities developed which were slow to clear. Treatment was not effective, although an ointment was soothing. The causal virus could be grown on tissue culture. Strict aseptic technique is advised to avoid the possibility of cross-infection from tonometers or eye droppers.

Lawrence L. Garner.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Basterra, J. **Central serous chorioretinitis.** Arch. Soc. oftal. hispano-am. **16**: 394-408, March-April, 1956.

The literature on the subject is reviewed, extensive reference is made to the article of Mitsui and Sakanashi, and four cases reported. Three of the cases belonged to the type described by Mitsui and Sakanashi as circumscribed retinal detachment. The author's fourth case had in addition to the foveal detachment, retinal edema outside of the fovea. The clinical course, the ophthalmoscopic appearance, and the differential diagnosis are discussed in detail. (21 references)

Ray K. Daily.

Buiz Barranco, Francisco. **Pathogenesis and treatment of non-specific iridocyclitis.** Arch. Soc. oftal. hispano-am. **16**:499-514, May, 1956.

The author divides uveitis into two forms. Uveitis as a disease with a specific etiology, and uveitis syndrome with a non-specific etiology. The factors participating in the etiology of non-specific uveitis are the toxic, allergic, hormonal, and neurogenic. The author believes that the neurogenic is the most important and basic factor, the others being secondary. For therapy, nitrogen mustard was used in ten cases with nine cured, succinic acid in 25 cases with 11 cured and six improved irgapyrin and butazolidine in 50 cases with 41 cured and six improved. He concludes that the treatment of choice is butazolidine combined with succinic acid administered intravenously, and mydriatics locally. (2 tables, 11 references)

Ray K. Daily.

Crick, R. P. **Ocular sarcoidosis.** Tr. Ophth. Soc. U. Kingdom **75**:189-206, 1955.

The author reports 103 patients with sarcoidosis; the diagnosis was confirmed by biopsy in 63 patients and in 21 of them an eye was involved. Anterior uveitis was found in 17 and chorioretinitis in 13. Disturbance in calcium metabolism was found in two patients with generalized sarcoidosis and these showed normal boneX-rays. The patients were found to be extremely sensitive to vitamin D. Cortisone appears to have an antagonistic action. (5 figures, 2 tables, 8 references) Beulah Cushman.

Cross, A. G. **Ocular sarcoidosis.** Tr. Ophth. Soc. U. Kingdom **75**:181-187, 1955.

Sarcoidosis, also known as Besnier-Boeck-Schaumann disease, is a granulomatous process which often affects the uvea and which may spread throughout the body. The uveitis of sarcoid is a chronic anterior uveitis which may persist for months or years; keratic precipitates are large and pale nodules which appear in the iris. Posterior iris adhesions are rare. Perivasculitis is a manifestation accompanied by retinal hemorrhages, exudates and sheathing of the vessels with patches of neovascularization.

Absolute diagnosis can only be made after a biopsy. (1 figure, 2 tables)

Beulah Cushman.

Faldi, S. and Comi, G. **The need for certain diagnostic investigations for the treatment of recurrent chronic uveitis.** Gior. ital. oftal. **9**:73-78, Jan.-Feb., 1956.

The prevalence of chronic uveitis in women suggested an investigation of the hormonal state of those affected, and it was found that in practically all cases there was an absolute or relative hyperfolliculinism. Skin tests with colchicum and tuberculin proved useful in determining the causes of the condition (focal or tuberculous infection). V. Tabone.

Hewson, G. Everhard. **A case of brucellosis.** Tr. Ophth. Soc. U. Kingdom **75**: 729-738, 1955.

A woman, 47 years of age, who complained of "foggy vision" was found to have cyclitis with retinal arteriolar spasm due to brucella abortus. A general survey of brucellosis is also given. (31 references) Beulah Cushman.

Leigh, A. G. **Lens-induced uveitis.** Tr. Ophth. Soc. U. Kingdom 75:51-65, 1955.

Six cases of lens-induced uveitis are described of which three were clearly of the nature of endophthalmitis phacoanaphylactica or of phacotoxic reaction. In the other three the unveitis appeared in the second eye after extracapsular cataract extraction in the first eye. The nature of the process of this inflammation is discussed. (4 figures, 11 references) Beulah Cushman.

Müller, Horst. **Recurrent hypopyon iritis with retinal angitis obliterans.** Klin. Monatsbl. f. Augenh. 129:289-300, 1956.

In two men (29 and 56 years of age) bilateral hypopyon iritis was accompanied by an obliterating vascular process of the retinal vessels which was examined histologically in one eye and seen ophthalmoscopically in the other patient. (4 figures, 21 references) Frederick C. Blodi.

Santoro, Nicola. **A case of implantation cyst of the iris.** Gior. ital. oftal. 9:89-94, Jan.-Feb., 1956.

A case of an iris cyst is described in detail and the therapy reviewed. The particular interest of this case was in the fact that the cyst appeared 32 years after a perforating injury. (1 figure, 18 references) V. Tabone.

Stanworth, A. and Sharp, J. **Uveitis and rheumatic diseases.** Ann. Rheum. Dis. 15:140-150, June, 1956.

Out of 237 consecutive patients, 209 with uveitis were examined for rheumatic diseases. In 25 percent of the cases nongranulomatous uveitis was found to be especially associated with Reiter's disease, ankylosing spondylitis and other forms of spondylitis. The uveitis may be the initial complaint. The association of uveitis with other diseases appeared to be coincidental. (1 figure, 8 tables, 52 references) Irwin E. Gaynon.

Wegner, W. **A new concept on the genesis of chronic recurrent uveitis, with special reference to Boeck's disease.** Arch. Soc. oftal. hispano-am. 16:299-317, March-April, 1956.

This is a comprehensive review of the literature on the changing concepts of the etiology of recurrent uveitis, and a report of the author's own clinical experience in a tuberculosis sanatorium. He found that the etiology in 17 percent of the patients with uveitis was Boeck's sarcoid. With the diagnosis of Boeck's sarcoid, 172 cases had iritis; 77 of these had iritic nodules; 36 had also a choroiditis; in 35 patients, or 20 percent, there was evidence of papillitis, and in 31 percent periphlebitis. In two-thirds of the patients the disease was discovered because of the ocular affection, the pulmonary lesion giving no symptoms. In 10 percent of the cases there were cutaneous or lymphatic lesions supporting the diagnosis. The relation between Boeck's sarcoid and tuberculosis is discussed, and the author affirms his belief that Boeck's sarcoid could be of tuberculous origin. In general, iritis caused by Boeck's sarcoid cannot be differentiated from chronic iritis of other etiology on the ocular symptoms alone. Even a thorough general examination does not assure a definite differential diagnosis. Of 172 patients with recurrent uveitis, the majority have retained useful vision; this favorable result is attributed to the absence of an exudative tendency in Boeck's sarcoid. However, 41 patients had severe impairment of vision. The local application of cortisone, which constituted the most important therapeutic

procedure, led to no complications. Large iritic nodules, resistant to the local administration of cortisone, responded to the general administration of this agent. Because there is danger of converting Boeck's sarcoid into a frank tuberculosis through the administration of cortisone, tuberculostatic drugs should be administered simultaneously with cortisone. An interesting feature of the author's experience was the improvement of the uveitic process during pregnancy. Presumably the increased secretion of ACTH during pregnancy exerts a favorable effect on the uveitic process; however, the author warns against permitting the patient to nurse the infant because of the reduced resistance which sets in with the cessation of the hypersecretion of ACTH. He also advises the administration of cortisone postpartum. (4 figures)

Ray K. Daily.

9

GLAUCOMA AND OCULAR TENSION

Akagi, G. **A study on the self-regulating mechanism of intraocular pressure.** Acta Soc. Ophth. Japan **60**:1425-1455, Sept., 1956.

A puncture of the midbrain causes a decrease or increase in the ocular tension depending on the site of the puncture. Any agents which stimulate or suppress the midbrain cause, respectively, an increase or decrease in the ocular tension. Akagi also observed two cases of pituitary tumor accompanied by simple glaucoma; stimulation of the trigeminal nerve results in an increase in ocular tension. He concludes that there is an autoregulatory center for the ocular tension in the midbrain. The centripetal pathway is in the trigeminal nerve and the centrifugal pathway is in the autonomic nerves. (22 figures, 23 tables, 43 references)

Yukihiko Mitsui.

Becker, B. and Christensen, R. E. **Water-drinking and tonography in the diagnosis of glaucoma.** A.M.A. Arch. Ophth. **56**:321-326, Sept., 1956.

The authors studied 175 normal eyes and 188 eyes with chronic simple (open angle) glaucoma with loss of visual field, by means of tonometry, the water drinking test, and tonography. The best method of recognizing incipient glaucoma was found to be by the use of tonographic tracings one hour after drinking one liter of water. The ratio of intraocular pressure to outflow facility was much higher in the glaucoma series. (4 figures, 1 table, 7 references) G. S. Tyner.

Beckett, H. C., Anderson, J. R., Armstrong, K. B., O'Day, K., Hertzberg, R. and Lowe, R. F. **Symposium on glaucoma.** Tr. Ophth. Soc. Australia **15**:39-71, 1955.

Beckett, H. C. **The early diagnosis of glaucoma.** pp. 39-43.

The earliest signs of simple glaucoma are scotomas above and below the blind spot. Routine screen field tests take a very few minutes and should be performed by ophthalmologists on all patients over 40 years of age. Diagnosis can be confirmed by the two hourly tension curve. (14 references)

Anderson, J. Ringland. **The medical treatment of glaucoma.** pp. 44-58.

Miotic therapy is discussed under the following headings—action, objectives, use, criteria of failure, causes of failure, aids to success. The whole life of the patient must receive consideration. An addendum lists "Advice to Patients with Glaucoma." (9 figures, 23 references)

Armstrong, K. B. **The operative aspect of glaucoma.** pp. 59-60.

Armstrong's discussion is brief and general.

O'Day, Kevin. **Pathology of glaucoma.** pp. 61-63.

This brief discussion is concerned

mainly with diurnal variations of ocular tension. (3 references)

Hertzberg, R. **Congenital glaucoma.** pp. 64-66.

The author discusses congenital glaucoma and goniotomy as the treatment of choice. (9 references)

Lowe, Ronald F. **Malignant glaucoma.** pp. 67-71.

Lowe presents Chandler's views. (1 figure) Ronald F. Lowe.

van Beuningen, E. G. A. and Fischer, F. W. **Method of tonography and gonioscopy.** Klin. Monatsbl. f. Augenh. **129**: 202-210, 1956.

The nomogram of the Tonometry Committee (1954) assumes too low a rigidity coefficient. It also indicates that the heavier weight may cause less change in volume than the lighter weights. This seemed contradictory and photographic control showed that this is not the case. A continuous differential tonography is advised for an estimation of ocular rigidity. In this procedure the plunger weight is changed while the tonometer rests on the eye. It is further indicated that a new method of photography in gonioscopy is being developed. (7 figures, 12 references) Frederick C. Blodi.

Boyd, T. A. S. **Comparison of surgical and conservative treatment in glaucoma simplex.** Tr. Ophth. Soc. U. Kingdom **75**: 541-560, 1955.

The author reviewed the records of patients attending the Oxford Eye Hospital from 1930-1953 and made a statistical analysis of the deterioration of the visual field of all eyes with glaucoma simplex and tension over 30 mm. The eyes treated surgically and conservatively were divided into groups according to tension and field loss at the beginning of treatment and these data were compared with similar data taken in six successive years. It was found that the surgically treated eyes lost more than those treated conservatively. (7 figures, 8 tables, 7 references) Beulah Cushman.

Breinin, Goodwin M. **The clinical application of carbonic anhydrase inhibitor (acetazoleamide) in ophthalmology.** Tr. Penn. Acad. Ophth. **9**:61-73, Summer, 1956.

The author presents not only all pertinent pharmacologic data but also an extensive analysis of the clinical value and limitations of acetazoleamide. This drug is an important agent in the control of all types of glaucoma but is best suited to short-term administration. A high incidence of side reactions limits its value for continued use. (6 figures, 32 references) Irwin E. Gaynon.

Cavka, V. **The frontal and diencephalic regulating center in glaucoma.** Arch. d'opht. **16**:507-530, June, 1956.

Cavka reviews the literature dealing with central regulation of intraocular pressure and reports on pneumo-encephalographic findings in 21 cases of primary glaucoma. All showed cortico-subcortical atrophy of the frontal lobe and eight cases showed a frontoparietal atrophy. The ventricular system was enlarged in 12 cases; the chiasmatic cistern showed a dilatation in 10 cases and the interpeduncular cistern showed it in five. There was also evidence of diencephalic-mesencephalic atrophy. Signs and symptoms suggesting an old chronic encephalitis were uniformly present. Five cases of bilateral transfrontal lobotomy, and one case of unilateral frontal lobectomy, examined before and after surgery, were studied in regard to ocular tonus and in relation to brachial and retinal arterial pressure. The findings, according to the author, suggested the presence of a regulatory center in the frontal lobes. He concludes by formulating a theory of the origin of primary glaucoma in which there is initially

an inflammation or intoxication leading to atrophy of the frontal-diencephalic parts of the brain which in turn leads to a neuro-vegetative disfunction manifesting itself in glaucoma. P. Thygeson.

Constant, M. A. and Becker, B. **Experimental tonography. II. The effects of vasopressin, chlorpromazine, and phentolamine methanesulfonate.** A.M.A. Arch. Ophth. **56**:19-25, July, 1956.

The effect of these substances was a profound suppression of aqueous flow and lowering of ocular tension. (7 tables, 11 references) G. S. Tyner.

Diaz Dominguez, Diego. **Pathologic basis for the surgical treatment of glaucoma.** Arch. Soc. oftal. hispano-am. **16**: 409-418, March-April, 1956.

Like Weekers, the author uses the Schiøtz tonometer for tonography, and calculates the coefficients of resistance and outflow. He describes the clinical application of the data thus obtained for the differential diagnosis of the type of glaucoma, the underlying pathologic processes, and the selection of the antiglaucomatous surgical procedure. (7 references) Ray K. Daily.

Douglas, D. H. **Goniotomy in buphthalmos.** Tr. Ophth. Soc. U. Kingdom **75**:739-745, 1955.

The author carried on the work of Dr. J. B. McArevey who reported 14 cases of buphthalmos treated by goniotomy as advocated by Barkan. Douglas excluded two of the original series because the patients were eight years old when they had goniotomy. To these he added 15 eyes of 10 patients making a total of 36 eyes. Of the 28 eyes in which the tension was normalized two eyes had three, five two and 16 eyes had one operation. The visual acuity in these eyes was 6/6 or 6/9 in seven eyes, 6/12 to 6/18 in four, 6/24 in four, 6/36 in two, and 6/60 in one eye. Eight eyes did not have normalized pressure. (7 references) Beulah Cushman.

Gramberg-Danielsen, B. **Megaphen (chlorpromazine) in ophthalmology.** Klin. Monatsbl. f. Augenh. **129**:252-254, 1956.

This drug was used successfully in 60 patients with various forms of glaucoma. (9 references) Frederick C. Blodi.

Grant, W. M. and Trotter, R. R. **Clinical evaluation of tonography.** Tr. Penn. Acad. Ophth. **9**:79-86, Summer, 1956.

It is not likely that tonography will be practised outside special clinics because it is time consuming, requires complex and expensive equipment, and has many potential sources of error. The diagnosis of glaucoma by tonography added to gonioscopy and standard ophthalmic examination seems better than by ordinary tonometry or by the water-drinking test. It provides quantitative information on the hydrodynamics of the eye but not on the vulnerability of the optic nervehead. It gives little practical help in regulation of open-angle glaucoma. (2 figures, 1 table, 2 references) Irwin E. Gaynon.

Hammer, J. **Three years of experience with the glaucoma pamphlet in private practice.** Klin. Monatsbl. f. Augenh. **129**: 375-378, 1956.

This instructive pamphlet designed by Müller and Thiel was given to 540 patients with glaucoma; 90 percent of them returned regularly for checkup. (2 figures, 6 references) Frederick C. Blodi.

Hofmann, H. and Seidl, W. **Results of medical and operative glaucoma therapy.** Klin. Monatsbl. f. Augenh. **129**:211-218, 1956.

In this study 640 eyes were evaluated. In closed-angle glaucoma surgical intervention gave better results. This was also true for open-angle glaucoma if it is not

compensated. The classification of the authors does not lend itself to a clear-cut analysis. (5 tables, 12 references)

Frederick C. Blodi.

Iinuma, I., Ando, J., Muraji, K. and Kawasaki, Y. **Use of anthramilic acid, a metabolite of tryptophane, in simple glaucoma.** Acta Soc. Ophth. Japan **60**:954-962, Aug., 1956.

This interesting study was undertaken under the working hypothesis that simple glaucoma may be due to a disturbance in the metabolism, probably of tryptophane. Anthranilic acid is given by mouth at the rate of 0.2 to 0.6 mg. per Kg. body weight every day. In seven cases of simple glaucoma, a normalization of glucose tolerance in vivo, ocular tension, diurnal variation of ocular tension and visual field resulted after a three weeks' treatment. In eight other cases, the same thing occurred after one to four months' treatment. (7 figures, 4 tables, 26 references)

Yukihiko Mitsui.

Jervey, J. W. **Tonometry and the cornea.** A.M.A. Arch. Ophth. **56**:109-127, July, 1956.

A study of 4,000 eyes subjected to tonometry leads the author to believe that protection of the cornea can be had by instilling a drop of 1-percent methyl cellulose just before taking the tension. Mechanical abrasion of the instrument plus the effect of the topical anesthetic produce disturbances in the corneal epithelium. (12 figures, 7 tables, 76 references)

G. S. Tyner.

Kapuscinski, W. J., Fabian, A., Wozniakowa, I. and Sidorowicz, L. **High myopia and glaucoma.** Klinika Oczna **26**:53-65, 1956.

The relationship of high myopia to glaucoma was investigated in 53 cases. The following tests were performed: 1. visual acuity with and without correction, 2. ophthalmoscopy, 3. retinoscopy, over the disc, the macula and the periphery, 4. perimetry, 5. light adaptation and 6. ocular tension within 15 minutes after instillation of pilocarpin. The authors found two patients in whom the ocular tension was elevated and the nasal visual field was reduced. One of them had bilateral glaucomatous cupping. In eight additional cases loss of nasal visual field was found together with lowered adaptation but without increase of ocular tension. Only degenerative changes characteristic of high myopia were seen in the retina. The authors felt that despite low pressure these eight patients were glaucomatous. Together there were 10 cases of glaucoma or 18.8 percent and the authors considered this significant. (2 tables, 44 references)

Sylvan Brandon.

Kiritoshi, Y. **Rigidity of ocular coat. III.** Acta Soc. Ophth. Japan **60**:983-998, Aug., 1956.

The author reports measurement of the rigidity of the ocular wall and its diurnal variation in glaucoma (27 cases), essential ocular hypotony (15 cases), other ocular conditions (18 cases) and normal controls (4 cases). The rigidity of the ocular wall in glaucoma is in the normal range. A reduction in the elasticity of the sclera does not seem, therefore, to play a role in the manifestation of glaucoma. The diurnal variation of ocular rigidity is compensational to that of ocular tension. But, contradictory to Kleinert, the diurnal variation of the rigidity is greater in glaucoma than in normal controls. The greater variation of the rigidity in glaucoma may be explained by the conception of water metabolism in the sclera of Fischer. The rigidity is small in disorders of the uvea, cornea and sclera. Finally, Kiritoshi states that among cases of "essential ocular hypotony," an apparent hypotony which is actually due to a decrease

in the rigidity of the wall is involved. (9 figures, 8 tables, 23 references)

Yukihiko Mitsui.

Kishimoto, M. **Variation in ocular tension and biomicroscopic aspect of the aqueous vein.** Acta Soc. Ophth. Japan **60**:1389-1425, Sept., 1956.

In this extensive study, Kishimoto measured the rate of aqueous outflow through the aqueous vein. The estimation was made by determining the ratio of the width of the clear aqueous column to that of the red blood column in the aqueous vein by a biomicroscopic observation. Thus the rate of flow of the aqueous through this vein was divided into five degrees. He then studied the relation between the ocular tension and the relative rate of flow of the aqueous through the vein. He applied some provocative procedures for glaucoma to 32 normal and 26 glaucomatous eyes. The increase or decrease of the intraocular pressure by the provocative tests did not necessarily show a parallel relation to a decrease or increase of the aqueous outflow through the vein. The diurnal variation of ocular tension also showed no constant relation to it. In some eyes, for example, an increase in the aqueous outflow was observed during the increasing phase of the ocular tension. Thus he concludes that the aqueous outflow through the aqueous vein may not play an important role in the regulation of the ocular tension. (45 figures, 5 tables, 63 references)

Yukihiko Mitsui.

Law, T. B. and Kerkenezov, N. **Juvenile glaucoma, with report of a case.** Tr. Ophth. Soc. Australia **15**:162-166, 1955.

One case is reported (2 figures).

Ronald F. Lowe.

Leydhecker, W. and Meinke, A. **Should the ocular tension of glaucoma patients be taken in the morning before or after arising?** Arch. Soc. oftal. hispano-am. **16**: 348-354, March-April, 1956.

Leydhecker confirms the opinion expressed by Thiel in 1925, to the effect that the ocular tension in glaucoma patients should be taken in the morning before the patient gets out of bed. Leydhecker's present series of investigations comprised 77 eyes of 40 patients. The tension was taken just before arising and ten minutes later. In 13 patients there was a fall of 4 to 6 mm. Hg in ocular tension after arising, and in one a rise in tension. This variation in tension is attributed to the postural change, which influences the ocular vascular circulation. Leydhecker believes that the eye probably reacts to the postural change in a manner similar to that of the cerebrum; the vasodilatation reduces the uveal circulation and with it the ocular tension. (3 tables, 6 references)

Ray K. Daily.

Moreu, Angel. **The physiopathology of true glaucoma.** Arch. Soc. oftal. hispano-am. **16**:423-437, March-April, 1956.

This is a reiteration of the author's conception of glaucoma as a neuroendocrine dysfunction, with repercussions on the circulation in ocular vessels and of the aqueous. These changes manifest themselves in a disturbance of the regulation and rhythm of the ocular tension, with a tendency to a permanent or intermittent rise, and to dystrophy or degeneration of the ocular tissues, ending in blindness.

Ray K. Daily.

Perkins, E. S. **Diamox in the treatment of glaucoma.** Tr. Ophth. Soc. U. Kingdom **75**:207-217, 1955.

Diamox produces its hypotensive effect by reducing the formation of aqueous in a wide variety of conditions. The inhibition by diamox of carbonic anhydrase in the kidney decreases the tubular re-absorption of sodium, bicarbonate and potassium, causing a diuresis. Diamox

was found to be of great value in acute angle-closure glaucoma with the standard miotic treatment, in glaucoma secondary to iridocyclitis, and in long term treatment of chronic open-angle glaucoma. Aphakic glaucoma also responds to diamox and it is of help in restoring the anterior chamber after intraocular operations. Only transient lowering of the tension was found in hemorrhagic glaucoma.

Diamox is a diuretic and severe side effects may be severe vomiting, paresthesia of hands and feet, and sulphemoglobinemia.

Diamox is a useful addition to the intensive use of eserine in acute glaucoma, in chronic congestive and chronic simple glaucoma. In lowering the intraocular pressure where miotics alone have failed, the synergic action of diamox and miotics may succeed when either alone is ineffective. (2 figures, 2 tables, 8 references)

Beulah Cushman.

Richter, G. and Sautier, V. **The frequency of glaucoma.** Klin. Monatsbl. f. Augenh. **129**:218-224, 1956.

Of 1,981 apparently normal eyes which were examined, 121 had a suspiciously high intraocular pressure; 37 eyes could not be followed and in 48 eyes all other tests for glaucoma remained negative. Eleven eyes remained in which glaucoma was suspected and 25 eyes probably had glaucoma.

The incidence of unsuspected glaucoma in this series of the clinic in Munich is considerably smaller than the incidence found by Leydhecker in Bonn. However, the criteria were not exactly identical nor was scleral rigidity evaluated in the latter series. (7 tables, 5 references)

Frederick C. Blodi.

Schmidt, Theo. **Progress in differential tonometry.** Klin. Monatsbl. f. Augenh. **129**:196-202, 1956.

The new applanation tonometer for the slitlamp (Goldmann) allows a determination of the intraocular pressure with less weight (one-tenth of the intraocular pressure) than the weight used in a Schiøtz tonometer. The change in volume is much smaller and the difference between P_t and P_o averages 3 percent. The ocular rigidity is therefore of no importance in this type of tonometry.

This applanation tonometer is also preferable for a determination of the ocular rigidity. Its reading is compared with the 10 or 15 gm. weight of the standardized Schiøtz tonometer. The rigidity was measured in 52 normal eyes and is presented in a nomogram. The mean rigidity coefficient was 0.0225 and its standard deviation was 0.00893. (1 figure, 2 tables, 4 references) Frederick C. Blodi.

Weekers, R. and Delmarcelle, Y. **Pathogenesis and treatment of ocular hypertension developing in exophthalmos due to arteriovenous aneurysm.** Arch. d'opht. **16**:380-387, June, 1956.

Ocular hypertension is quite frequent in pulsating exophthalmos due to arteriovenous aneurysm between the internal carotid artery and the cavernous sinus. It results from neither an increased production of aqueous nor an outflow block. It is entirely attributable to an increase in blood pressure at the junction of aqueous and blood veins. Ligature of the carotid is both the treatment of choice of the arterio-venous aneurysm and of the complicating ocular hypertension. It normalizes the ocular tension by returning the episcleral venous pressure to physiologic limits. In certain cases, however, it provokes a temporary ophthalmomalacia as a result of reduction in aqueous output due to ischemia of the ciliary body. This ocular hypotension disappears when collateral circulation permits re-establishment of the ciliary circulation.

P. Thygeson.

10

CRYSTALLINE LENS

Coates, J. E. and Keatinge, G. F. **Incidence of lens changes in an iron rolling mill.** Tr. Ophth. Soc. U. Kingdom **75**:653-665, 1955.

It was found that capsular striation appears early. Exfoliation of the anterior capsule occurs much later, in the group 51 to 55 years of age, and posterior changes, which show a steady progression with continued exposure to heat appear in the group of men 41 to 45 years of age. Changes in the posterior cortex appear in the group of men 66 to 70 years of age after 50 years in the industry. (1 figure, 1 table, 15 references)

Beulah Cushman.

Dunnington, John H. **(Bowman lecture). Ocular wound healing with particular reference to the cataract incision.** Tr. Ophth. Soc. U. Kingdom **75**:137-171, 1955.

The modern concepts of wound healing have been analyzed after experimental studies which include tensile strength of limbal wounds, tissue responses to absorbable and non-absorbable sutures, effect of cortisone, ACTH, thrombin and heparin; the effect of increased intraocular tension, delayed formation or subsequent loss of the anterior chamber; post-operative administration of diamox; bleeding into the anterior chamber and use of silk sutures. Tissue incarceration, stromal proliferation, epithelial invasion were found in the pathological processes which were responsible for the removal of the eyes. Corneo-scleral sutures have greatly reduced these complications. (7 figures, 111 references)

Beulah Cushman.

Klecker, Wilhelm. **Orbital hemorrhage after retrobulbar injection.** Klin. Monatsbl. f. Augenh. **129**:392-395, 1956.

Retrobulbar hemorrhages were seen a few times in 2,750 cataract extractions. However, in two cases an optic atrophy by pressure ensued. (13 references)

Frederick C. Blodi.

Pau, Hans. **Is the senile cataract a permeability cataract?** Klin. Monatsbl. f. Augenh. **129**:371-374, 1956.

In the typical senile cortical or nuclear cataract no permeability changes of the lens capsule have to be assumed. On the other hand, true permeability cataracts (posterior cupuliform) can be found in senile patients. (5 references)

Frederick C. Blodi.

Schenk, H. **A foreign body in a clear lens.** Klin. Monatsbl. f. Augenh. **129**:259-261, 1956.

This foreign body (stone) was observed for 11 years. It caused only minimal, circumscribed lens opacities. 24 references)

Frederick C. Blodi.

Simonelli, Mario. **Sunflower cataract.** Gior. ital. oftal. **9**:18-31, Jan.-Feb., 1956.

A case of this type of cataract is described; the opacity was situated in the entire subcapsular region. The cause was a foreign body lodged between the sclera and the ciliary body. The cataract appeared 18 months after injury and resolved completely after removal of the foreign body, which was a filament of copper. The effect of chalcosis on the lens is discussed. (3 figures, 37 references)

V. Tabone.

Smith, Redmond. **Histopathological studies of eyes enucleated after failure of intra-ocular acrylic operations.** Brit. J. Ophth. **40**:473-479, Aug., 1956.

Nine eyes are described, each of which was removed because of an intense anterior chamber reaction with or without glaucoma. The inflammatory reaction was associated with fibrosis which formed an extensive pseudocapsule about the acrylic

lens. The reaction may be a response to an irritating foreign body, to the trauma of operation, to mechanical irritation of the plastic itself, or to a liberation from this plastic material of the absorbed antiseptic used for storage and asepsis. The exact role of the implant was difficult to evaluate since in four of these cases the prior removal of the lenticulus made such study inaccurate. A uniform fibrosis existed in each case and its anterior layer was found adherent to the disorganized posterior iris surface. The posterior layer was usually, but not always, adherent to the remnants of the posterior capsule in cases of extracapsular lens extraction. Eosinophils were noted in all but one case and giant cells were found in only three. The presence of fibrous tissue about the acrylic lens is apparently not related to the length of time the lens has been present. The amount of fibrous tissue seemed the same in all cases. This suggests that the lens is in itself not the cause. It is interesting to note that in a successful implantation which became available through the death of the patient, the eye revealed a similar degree of fibrous membrane formation associated with adhesive changes. (6 figures, 20 references) Lawrence L. Garner.

Tikhomirov, P. **Intracapsular extraction by erisophake.** Vestnik oftal. **4**:35-37, July-Aug., 1956.

The author used Bell's simplified erisophake in 25 cataract extractions. The age of the patients was from 62 to 83 years; in 19 patients the cataract was mature. The erisophake and its use are described in detail. In 12 patients the lens was extracted on the first application of the erisophake and in one after three applications. In 12 the suction was not sufficiently strong and the operation was finished by using Elshnig's forceps or, if the capsule was torn by the erisophake, as an extracapsular extraction. Tikhomirov believes that the erisophake should be ready at every cataract operation. (1 figure) Olga Sitchevska.

11

RETINA AND VITREOUS

Bargossi, Pasquale. **Statistical data on retinal detachment.** Gior. ital. oftal. **9**: 195-209, Jan.-Feb., 1956.

Analysis of statistical and clinical data in 225 cases of retinal detachment show that: 1. the condition is more frequent in myopic persons; 2. the incidence increases with age, is greatest between the ages of 40 and 60 years and then decreases; 3. right and left eye, and also male and female are affected equally often, and 4. the frequency is greater in June and August. The results of surgery (one or more attempts) in 171 cases gave a percentage of cure of 84.7. (2 figures, 41 references) V. Tabone.

Björk, A., Lindblom, U. and Wadensten, L. **Retinal degeneration in hereditary ataxia.** J. Neurol., Neurosurg. & Psychiat. **19**:186-193, Aug., 1956.

Five cases of hereditary ataxia with deterioration of vision are reported. The usual ophthalmologic procedures were all negative. By the use of electroretinography, the flicker ERG was found to be abnormal early in the disease, thus explaining the early disturbance of the cones with resultant loss of color vision and visual acuity. Later, the rod system becomes affected, as shown by the pathologic single flash ERG. In the late cases, ophthalmoscopy reveals a retinal degeneration with consecutive optic atrophy. (6 figures, 15 references) Irwin E. Gaynon.

Brihaye-van Geertruyden, Marthe. **Retinal lesions in Hodgkin's disease.** A.M.A. Arch. Ophth. **56**:94-99, July, 1956.

A patient with Hodgkin's disease is de-

scribed who showed "cotton-wool" fundus exudates. (4 figures, 19 references)

G. S. Tyner.

Callahan, Alston. **Angiomatosis retinae. Report of a case with histologic examination.** A.M.A. Arch. Ophth. **56**:16-18, July, 1956.

A patient with unilateral angiomatosis retinae submitted to enucleation. The author's diagnostic impressions were substantiated by histologic examination. (2 figures, 8 references) G. S. Tyner.

Campbell, D. R. and Gebertt, S. **Retinitis pigmentosa and choroideremia treated with intermedin.** Tr. Ophth. Soc. U. Kingdom **75**:667-682, 1955.

Intermedin, which is an extract of the intermediate lobe of the pituitary, and a melanophore hormone, was used in 19 patients, 14 with retinitis pigmentosa and five of choroideremia. There was a notable expansion of visual fields in eight patients and no change in five. Visual acuity was maintained but not improved. Expansion of the visual fields was intermittent and in various sectors. In five patients with choroideremia treated with intermedin very little improvement if any was observed in the visual fields. Intermedin does improve dark adaptation and in the absence of other efficacious treatment it should be used. (14 figures, 4 tables, 26 references) Beulah Cushman.

Doden, W. and Adams, A. **Neurologic examinations of patients with retinal periphlebitis.** Klin. Monatsbl. f. Augenh. **129**: 305-317, 1956.

In 947 patients with retinal periphlebitis no evidence of cerebral or spinal vascular damage or hemmorrhage could be found. No instance of associated thromboangiitis obliterans was found. On the other hand, sheathing of the retinal veins was found in 18 of 80 patients with multiple sclerosis. (2 tables, 46 references)

Frederick C. Blodi.

Everett, William G. **An experimental evaluation of scleral shortening operations.** A.M.A. Arch. Ophth. **56**:34-47, July, 1956.

The eyes of rabbits were subjected to the various types of scleral shortening operations, penetrating scleral resection, lemallar scleral resection, lamellar resection with polyethylene tubing, and the scleral fold. The authors conclude from their studies that a modified scleral fold operation is the procedure of choice. The recommended modification is to discontinue the separation of the choroid from sclera with a spatula. (16 figures, 8 references) G. S. Tyner.

Fison, Lorimer. **Observations on retinal detachments.** Tr. Ophth. Soc. U. Kingdom **75**:43-50, 1955.

Extensive examination with direct or indirect ophthalmoscopy was done in 73 problem cases and a cure was obtained in 42 patients with one operation, with two in 19 and with three in 12 patients. The indirect ophthalmoscopy was particularly helpful in determining the depth of the hole in the peripheral retina. (4 figures, 2 tables, 2 references)

Beulah Cushman.

Fracassi, Leonardo. **Coats' disease.** Gior. ital. oftal. **9**:235-241, Jan.-Feb., 1956.

A case of Coats' disease in one eye in a girl, 22 months of age, is described. The eye was enucleated and the histologic examination suggested that the lesions derive from vascular changes which are not inflammatory in nature. In this case Coats' disease was associated with angiomatosis of the retina. (3 figures, 24 references) V. Tabone.

François, J., Verriest, G. and de Rouck, A. **Electrooculography as a functional test in pathological conditions of the fundus.** Brit. J. Ophth. **40**:305-312, May, 1956.

The authors have studied an arbitrary

standardized base-value and a standardized drop during dark adaptation in the electrooculogram for normal and pathologic eyes. The base-value is not directly related to the subjective visual functions, the ERG, or the drop in the EOG during dark adaptation, but appears to offer a means of estimating the isolated function of the visual receptors. On the other hand, the drop during dark adaptation and the amplitude of the scotopic b-wave of the ERG are interrelated and their presence requires the existence not only of functional receptors but also of an intraretinal mechanism the apparent suppression of which is not incompatible with vision. Details are given of various cases of retinal diseases. (6 figures, 3 references) Morris Kaplan.

François, J., Verriest, G. and de Rouck, A. **Oguchi's disease.** Ophthalmologica **131**:1-40, Jan., 1956.

This report concerns a clinically typical case of Oguchi's disease in a 19-year-old male of Jewish descent, the twenty-second non-Japanese case thus far recognized and reported. The visual functions of the case were studied thoroughly, by the standard clinical methods as well as by the modern methods of flickerphotometry, electroretinography and electroencephalography. The authors arrive at the conclusion that Oguchi's disease should be classified among the congenital functional anomalies of night vision as a variant of essential congenital hemeralopia. It is unrelated to the tapeto-retinal degenerations, specifically unrelated to retinitis pigmentosa or retinitis punctata albescens. The electroretinogram in Oguchi's disease is characterized by absence of those components which are normally associated with scotopic vision. In bright or medium light the visual apparatus in Oguchi's disease functions fairly well as tested by standard clinical methods, but can be shown to be slightly defective by flickerphotometry or threshold measurements. All these anomalies can be attributed to a functional defectiveness of the rod system. (19 figures, 145 references) Peter C. Kronfeld.

Funder, Wolfgang. **The fate of patients with unilateral blindness due to a retinal detachment.** Klin. Monatsbl. f. Augenh. **129**:330-335, 1956.

Ninety-two patients could be followed and 26 of them developed a retinal detachment in the second eye (only seven patients in this group preserved a vision of 6/60 or better). Nine more patients acquired another ocular disease in the remaining eye (glaucoma, uveitis, endophthalmitis, perforation). It appears that the prognosis for good vision in the second eye is quite poor and every effort should be made to cure the detachment in the first eye. (5 tables, 8 references)

Frederick C. Blodi.

Gasteiger, H. **Results of Lindner's scleral resection in retinal detachment.** Arch. Soc. oftal. hispano-am. **16**:292-298, March-April, 1956.

An analysis of 87 cases of Lindner penetrating lamellar resection is tabulated. The retina was completely reapplied in 36 eyes, and six had a decided improvement. The author concludes that this surgical procedure will cure a large number of retinal detachments with a poor prognosis, such as eyes without a retinal tear, aphakic eyes, and eyes operated upon previously without success. (2 tables, 6 references) Ray K. Daily.

Janert, H., Mohnike, G. and Guenther, L. **Ophthalmologic studies of diabetes. II. Communication.** Klin. Wchschr. **24**: 807-813, Aug. 1, 1956.

The data on which this analysis of the fundus studies of 2,600 controlled diabetics is based have been published in part I of the communication. Almost one-

third of the 2,600 diabetics, with no difference in incidence in the sexes, had a retinopathy. Before 18 or 20 years of age retinopathy is a rarity. Up to the fourth decade there is positive correlation to age of observation and negative correlation to age of manifestation. After this age the relationship becomes less clear. The retinopathy usually develops after at least five years of duration of diabetes and is positively correlated to this figure. The retinopathy is more marked and more rapidly progressive in proportion to the youth of the patient when the diabetes became manifest and also to the degree of decompensation of the disturbed metabolism per unit of time. The authors assume that cataract and retinopathy in diabetes arise from different processes. (5 figures, 19 references)

F. H. Haessler.

Keith, C. G. **Angioid streaks and pseudoxanthoma elasticum.** Brit. J. Ophth. **40**:480-486, Aug., 1956.

A review of the literature on angioid streaks and pseudoxanthoma elasticum is presented and a single case is described. The disease involves areas of the skin where it is easily seen, and the eye where vision is disturbed in most cases. The fundus picture forms variations but usually presents some type of peripapillary pigmentation from which varied colored streaks may be seen extending towards the equator. A grayish zone about the nerve head is usually noted. (1 figure, 28 references) Lawrence L. Garner.

Kimura, S. J., Carriker, F. R. and Hogan, M. J. **Retinal vasculitis with intraocular hemorrhage.** A.M.A. Arch. Ophth. **56**:361-374, Sept., 1956.

Retinal vasculitis with intraocular hemorrhage (ordinarily termed Eale's disease) consists of a series of related entities which affect the eyes of young persons, principally males. The authors prefer the term "retinal vasculitis" because the changes are not always limited strictly to the veins as previously thought. The literature fails to agree on the etiology.

Twenty-one cases were studied in detail at the Doheny Foundation and no proof of a defect in the hemostatis mechanism could be shown as a cause of the hemorrhage. The lesions seen are classified as primary, secondary, and postchoroiditic. The pathologic examinations showed no evidence of a tuberculous origin. (2 figures, 1 table, 27 references)

G. S. Tyner.

Kittel, V. **Ocular involvement in periarteritis nodosa.** Klin. Monatsbl. f. Augenh. **129**:300-305, 1956.

A 49-year-old woman with periarteritis nodosa had occlusion of the central retinal artery in both eyes within a few days. (2 figures, 18 references)

Frederick C. Blodi.

Lerman, Sidney. **Diabetic retinopathy.** Canad. M.A.J. **75**:191-193, Aug. 1, 1956.

Recent work at the Wilmer Eye Institute concerning the pathogenesis of diabetic retinopathy is described briefly. The incidence of diabetic retinopathy has tripled since 1924 whereas that of diabetic cataract and glaucoma has remained about the same. The duration of the diabetes correlates with the retinopathy much better than does the percentage of control. The retinopathy is not due to arteriosclerosis, because only about 50 percent of cases show retinal arteriosclerosis. New evidence indicates that insulin lack may be only part of the etiology of diabetes. The effect of ACTH to cause diabetes and increase retinopathy has been demonstrated. However, there is also abnormal mucoid metabolism which can be exaggerated by use of cortisone. The enzymatic processes of the muco-

polysaccharides are now being studied. (34 references) Paul W. Miles.

Pau, Hans. **Sclerosed foci of the retina in idiopathic detachment.** Arch. Soc. oftal. hispano-am. **16**:377-385, March-April, 1956.

The histologic study of two eyes with idiopathic retinal detachment, enucleated in patients who died of intercurrent diseases, showed the presence of two membranous formations of the vitreous adherent to the retina; one anterior and the other posterior. Between these two membranes, the retina was found replaced by a vascular connective tissue with marked hyalinization and dispersion of retinal pigment. The retinal tears were situated between the posterior edge of this sclerosed retinal focus and the healthy retina. If the connective tissue involves the entire retinal thickness and is adherent to the choroid, this adhesion appears to prevent the formation of retinal tears. If the connective tissue is thin, traction on it by the posterior membranous band of the vitreous produces a retinal hole. (10 microphotographs, 5 references)

Ray K. Daily.

Paufique, L. **Retinovitreous hemorrhage in a prediabetic, induced by a provocative hyperglycemia.** Arch. Soc. oftal. hispano-am. **16**:275-277, March-April, 1956.

Paufique describes a clinical picture of retinal and vitreous hemorrhage, which appears in patients without glycosuria and with normal blood sugar, and in whom the disturbed sugar metabolism is found only through a glucose tolerance test. He reports five cases of this type, four with retinal hemorrhages, and one with a vitreous hemorrhage. The ocular symptoms are similar in all these cases: punctiform retinal hemorrhages, or diffuse vitreous hemorrhage, without retinal exudates, venous thrombosis, or arterial hypertension. A strict diet led to the regression of the hemorrhages and an improvement in the general state of the patient. Paufique discusses the metabolic changes which may account for this early ocular involvement, and believes that a glucose tolerance test is indicated in clinical cases in which an otherwise exhaustive general examination fails to reveal the etiology of the hemorrhages.

Ray K. Daily.

Payne, I. W. and Crick R. P. **Ectopia of the macula.** Brit. J. Ophth. **40**:492-496, Aug., 1956.

Fourteen previously reported cases are reviewed and three additional cases are presented. Since two of these occurred in patients who were premature and required oxygen, the possibility that the fundus findings may be related to retrolental fibroplasia is a strong one here. Displacement of the macula due to cicatricial changes in the retina as a result of periphlebitis explains the third case. (3 figures, 10 references)

Lawrence L. Garner.

Pietrowa, Nonna. **Retinal hemorrhages.** Klinika Oczna **26**:67-82, 1956.

The author examined 110 newborn within a few hours after birth. Atropine ¼ percent was used as a mydriatic without complications. The appearance of the eyegrounds in the newborn is described. In 18 cases retinal hemorrhages were found, which she classified as 1. petechial, 2. flame-like, 3. irregular and 4. patchy. Repeated examination showed that petechial hemorrhages were absorbed within 24 to 48 hours. Hemorrhages of groups 2 and 3 took a few days to disappear and the last one took about two weeks. In a month there was no trace left. Retinal hemorrhage may appear after any delivery. Birth trauma and difficulties during delivery are important but apparently there is some general abnormality which brings it on. The author feels that low

third of the 2,600 diabetics, with no difference in incidence in the sexes, had a retinopathy. Before 18 or 20 years of age retinopathy is a rarity. Up to the fourth decade there is positive correlation to age of observation and negative correlation to age of manifestation. After this age the relationship becomes less clear. The retinopathy usually develops after at least five years of duration of diabetes and is positively correlated to this figure. The retinopathy is more marked and more rapidly progressive in proportion to the youth of the patient when the diabetes became manifest and also to the degree of decompensation of the disturbed metabolism per unit of time. The authors assume that cataract and retinopathy in diabetes arise from different processes. (5 figures, 19 references)

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levels of prothrombin may be the reason and suggests administration of vitamin K to mothers before the delivery. Despite the fact that no damage could be seen in the retina there may be some later loss in the function of the eye. Six cases are presented for illustration. (4 figures, 16 references) Sylvan Brandon.

Schimek, Robert A. **Hypophysectomy for diabetic retinopathy.** A.M.A. Arch. Ophth. **56**:416-425, Sept., 1956.

Adrenal and pituitary factors in diabetic retinopathy suggest that hypophysectomy may be of value. Five diabetics so treated have stopped losing vision and having severe repeated hemorrhages in the retina. The period of observation has been too short, however, to lightly urge this formidable surgical procedure which dooms the patient to a lifetime of glandular replacement therapy. (5 tables, 39 references) G. S. Tyner.

Serpell, Geoffrey. **The experimental pathology of retrolental fibroplasia.** Tr. Ophth. Soc. Australia **15**:175-185, 1955.

This paper elaborates some observations made during the study of experimental retrolental fibroplasia induced in kittens. Oxygen-induced retinal vascular phenomena are compared with retinitis proliferans and ocular neovascularisation. Histochemical studies showed glycogen granules in developing mesenchymal cells in the iris, choroid and cornea. Extramedullary hemopiesis was noted in the choroid of 30 percent of eyes from premature human infants. (11 figures, 14 references) Ronald F. Lowe.

Shapland, C. Dee. **Diathermy or scleral resection?** Tr. Ophth. Soc. U. Kingdom **75**:405-420, 1955.

The author compares the result obtained in a series of patients with separation of the retina treated by diathermy (1934-1946) with one in a series in which lamellar sclerectomy was used (1949-1954). Four hundred and thirty cases of retina detachment (255 in males, 175 in females) occurred in eyes classified in five refractive groups; emmetropia, hyperopia, myopia under five diopters, myopia over 10 diopters, and aphakic eyes.

Successful repositions were obtained in 58.7 percent of the series 1949-1954 and in 43 percent of the diathermy failures in which sclerectomy was done subsequently. He concludes that lamellar sclerectomy improved the prognosis by 15 percent. (3 figures, 10 tables, 8 references) Beulah Cushman.

Steward, J. K., Smith, J. L. S. and Arnold, E. L. **Spontaneous regression of retinoblastoma.** Brit. J. Ophth. **40**:449-461, Aug., 1956.

The literature on spontaneous regression is reviewed and 15 cases are cited. A sixteenth case is presented in an adult patient of 37 years and evidence of retinoblastoma in childhood is described. Two of his children, each with retinoblastoma at present as well as a history on the father's side of a similar lesion attest to the validity of the diagnosis. In the present case the patient developed spontaneous phthisis bulbi in one eye and, in the other, a solid white lobulated mass adjacent to a large agea of chorio-retinal atrophy. This remained stationary and the remainder of the fundus was normal. No treatment of any type had been given during the course of observation. Apparently no explanation exists for spontaneous regression, and although several theories are described, none is satisfactory. In several instances, regression was noted in one eye whereas the lesion continued to progress in the other. The rare possibility of spontaneous regression does not justify delay in treatment. (5 figures, 1 table, 37 references)

Lawrence L. Garner.

Tayebi, Hooshang. **Ocular calcification and retrolental fibroplasia.** Am. J. Roentgenol. **76**:583-593, Sept., 1956.

Radiologic study was made of 41 eyes in cases of retrolental fibroplasia, using a modified Water's projection with hyperextension of the head which projects the eyeball onto the roof of the orbit. Distinct calcification was noted in 19 of the cases. The different types of calcification noted were lens calcification; "crescent calcification" of the choroid; "spot" calcification; and the "calcifying shrunken globe." Various causes of primary and secondary or metastatic calcification are discussed. The author stresses the point that calcification is no longer a definite diagnostic aid between retrolental fibroplasia and retinoblastoma. (9 figures, 35 references) Harry Horwich.

Vit, H. **Experiences with lamellar scleral resection.** Klin. Monatsbl. f. Augenh. **129**:324-330, 1956.

The resection is done in the classical way and combined with a diathermy coagulation of the tear. Among 21 eyes with poor prognosis which were operated on, an anatomical reattachment occurred in 10. (3 figures, 1 table, 11 references) Frederick C. Blodi.

Waterworth, David. **Occlusion of the central retinal vein and its treatment with anti-coagulants.** Tr. Ophth. Soc. Australia **15**:147-158, 1955.

Some clinical and pathological features of incomplete and complete occlusion of the central retinal vein are discussed and their relationship to primary chronic glaucoma is considered. Patients under 55 years of age with a good cardiovascular system and relatively undamaged macula respond well to anticoagulant therapy. Elderly patients with advanced arteriosclerosis should not be submitted to the hazards of treatment unless an only eye is involved. Their prognosis is extremely poor. Incomplete venous occlusion in young people in good health will probably resolve without treatment. (2 figures, 5 tables, 27 references) Ronald F. Lowe.

12

OPTIC NERVE AND CHIASM

Carreras Duran, Buenaventura. **Indirect accidental trauma to the optic nerve.** Arch. Soc. oftal. hispano-am. **16**:386-393, March-April, 1956.

A player in a game of Rugby was struck in his right orbital region by his own knee as he was knocked down by the other players. In a few hours he developed chemosis of the lower lid and loss of vision in the right eye. Examination revealed a central scotoma extending 35 degrees around the fixation point. At the end of five months after the injury, central visual acuity was restored, but there remained a paracentral scotoma, and the optic nerve was atrophic. The lesion is attributed to a fissure in the optic canal, which was demonstrated roentgenographically. The mechanism of the production of fractures by contre-coup is discussed. (6 figures) Ray K. Daily.

Tunbridge, R. E. and Paley, R. G. **Primary optic atrophy in diabetes mellitus.** Diabetes **5**:295-296, July-Aug., 1956.

Two cases of primary optic atrophy and marked conductive deafness in siblings having juvenile diabetes mellitus are reported. (8 references) Irwin E. Gaynon.

13

NEURO-OPHTHALMOLOGY

Bonnet, Paul. **Trigeminal-sympathetic syndromes.** Arch. d'opht. **16**:361-379, June, 1956.

The author discusses in detail 1. the paratrigeminal sympathetic syndrome of Raeder and 2. trigeminal sympathetic neuralgia. His article begins with a full consideration of the anatomy of the

trigeminal nerve which receives from the sympathetic the fibers destined for control of the pupil, vasomotor fibers, and secretory fibers. He then mentions the various other syndromes of the cavernous sinus, nine in number, and differentiates them from the two syndromes under discussion. He describes Raeder's syndrome as characterized by a. progressive signs of compression of all branches of the trigeminal, including its motor branch, and b. signs indicative of paralysis of the oculopupillary fibers of the sympathetic (syndrome of Claude Bernard-Horner). He concludes that the syndrome described by Raeder in 1918 indicates a circumscribed lesion in the immediate neighborhod of the Gasserian ganglion. The syndrome of trigeminal-sympathetic neuralgia, on the other hand, is characterized by a. neuralgic pain over the distribution of the trigeminal nerve, b. the presence of the syndrome of Claude Bernard-Horner, and c. vasomotor disturbances and intense sweating, strictly localized to the sensory distribution of the nerve. The author concludes that this syndrome is frequently caused by an inflammatory focus, such as an abscessed tooth, lying in the sensory distribution of the trigeminal. P. Thygeson.

Burke, W. **Vascular disease and the visual pathways.** Tr. Ophth. Soc. Australia **15**:95-100, 1955.

The vascular anatomy of the visual pathways, visual failure due to arteriosclerosis and cranial arteritis thrombosis of the internal carotid artery and basilar artery disease are discussed briefly. (5 references) Ronald F. Lowe.

Cowan, R. F. **Ocular considerations in facial paralysis.** Canad. M.A.M. **75**:380-383, Sept. 1, 1956.

The anatomy involved in this condition is reviewed and the symptoms described. For therapeutic purposes the cases are divided into four groups: 1. the supranuclear lesions, 2. the lower motor neuron lesions with early recovery, 3. the lower motor neuron lesions with late recovery, and 4. the lower motor neuron lesions with loss of corneal sensation due to a disturbance of trigeminal fibers. For the first he suggests no treatment; for the second, instruction in proper blotting and moistening; for the third tarsorrhaphy; and for the fourth, tarsorrhaphy and concurrent use of a Tovell shield. (3 figures, 10 references) Harry Horwich.

Fine, M. and MacGlashan, C. B., Jr. **Unilateral internuclear ophthalmoplegia of vascular origin.** A.M.A. Arch. Ophth. **56**:327-337, Sept., 1956.

Internuclear ophthalmoplegia is an entity arising from lesions of the medial longitudinal fasciculus. The authors present four cases which indicate that the unilateral forms are most frequently due to vascular lesions. (4 figures, 15 references) G. S. Tyner.

Furtado, Diogo. **Disjunctive convergent strabismus.** Rev. Neurol. **94**:335-350, April, 1956.

Two cases of convergent disjunctive nystagmus are described in detail. At autopsy, the lesions were not in areas considered to be the convergence nuclei, but in the quadrigeminate bodies, cerebral peduncles, the region of the pineal gland, and the aqueduct of Sylvius. The nystagmus in the two cases appeared in spasms of convergence, with the rapid phase of pendulous movement toward the nose, similar to a case described by Walsh in his textbook, in which there was a tumor of the pineal body. Other cases in the literature show this rare syndrome to include tonic spasm of extra-ocular muscles with retraction of the globe in crises of short duration, paralysis of convergence and of other eye movements and pupil abnormalities.

In the first patient, the convergent simultaneous binocular nystagmus was slow, with about 30 returns per minute. The amplitude of nystagmus increased with voluntary following movements, but persisted with the eyes closed. There was no change in nystagmus upon head movements, but the spasms seemed related in onset with a rhythmic right arm movement. Autopsy showed encephalitis, with perivascular infiltrations in the cerebral peduncles, quadrigeminate bodies, and the brachium.

The second patient had headache, vomiting, vertigo, and nystagmus of a convergence type. Visual acuity was one-third and fields were diminished concentrically. There was no pupillary reaction to light or with accommodation, and consensual reactions were absent. The nystagmus rate was about 60 per minute, and stopped with the eyes closed. X-ray studies showed a tumor of the pineal gland. Ventriculograms showed dilated lateral ventricles and an obstructed aqueduct of Sylvius and fourth ventricle. On autopsy there were signs of increased intracranial pressure. The pineal tumor pressed on the quadrigeminate bodies and cerebral peduncles, and totally flattened the aqueduct.

In these two cases, there was no abnormality in the areas usually stated to be the centers for convergence. The nucleus of Perlia and the areas near the median longitudinal fasciculus were not involved. The authors state that these cases add to the evidence that there is no single nucleus or center for convergence. They cite the work of Warwick that convergence is regulated from the median part of the motor neurones of the third nerves. They emphasize Bender's idea that "eye centering" comes from a vast representation in the nervous system and is correlated with visual cortical stimulation. Bender pointed out that the rapid phase of ordinary optokinetic or vestibular nystagmus is normally convergent toward the median line and related to "eye centering." Movements of gaze are too complex to depend on a single cellular nucleus. Movements must depend on cerebral cortex representation on a conscious level, and only passively depend on motor elements. (11 figures, 16 references) Paul W. Miles.

Glees, M. and Zielinski, H. **Bitemporal central and paracentral scotomas in various affections around the sella turcica.** Klin. Monatsbl. f. Augenh. **129**:145-160, 1956.

Among 11 patients three had an opticochiasmatic arachnoiditis, five a pituitary adenoma, two a meningioma and one an epidermoid of the third ventricle. These bitemporal scotomas are quite characteristic for pathologic processes in the area of the sella but they allow no accurate topical or etiologic diagnosis. Most of the patients were referred to the hospital with the diagnosis of retrobulbar or optic neuritis by ophthalmologists. Exact scotometry is necessary in these patients. (12 figures, 9 references)

Frederick C. Blodi.

Lampis, Raffaele. **Synkinetic movements of the muscle supplied by the third nerve.** Gior. ital. oftal. **9**:210-216, Jan.-Feb., 1956.

A case is described in which forced elevation of the upper lids is accompanied by an involuntary action of both internal rectus muscles and by miosis in both eyes. The phenomenon is discussed, and the possible association paths between the center of lid elevation and convergence is reviewed. (2 figures, 16 references)

V. Tabone.

Lewis, D. H. and Duane, T. D. **Electroretinogram in man during blackout.** J. Appl. Physiol. **9**:105-110, July, 1956.

Electroretinograms were made in five

subjects who were subjected to varying degrees of accelerative stress on the human centrifuge, including unconsciousness. Complete "blackout" did not extinguish the electroretinograms, although the consensual pupillary light reflexes were lost. In blackout one expects the nerve block to be in the visual cortex, but when finger pressure was placed on the eyeball, the gravity level required to produce blackout was diminished, therefore, the eye is involved. Since the electroretinogram is not extinguished, the block is most likely in the retinal ganglion cell synapse level. The pupillary reflex must follow a different fiber path, and perhaps consists of only two cells and one synapse instead of the three in the visual pathways. Paul W. Miles.

Miani, Paolo. **Posterior Sylvian syndrome after surgery for mitral stenosis.** Gior. ital. oftal. 9:109-117, Jan.-Feb., 1956.

A patient is described in whom congruous homonymous hemianopsia developed 15 days after an operation for mitral stenosis. The probable etiologic factor is an embolus lodging in the posterior Sylvian artery of the opposite side. (24 references) B. Tabone.

Minton, Joseph. **Intracranial aneurysms of the internal carotid and cerebral arteries.** Tr. Ophth. Soc. U. Kingdom 75: 81-100, 1955.

The diagnosis of intracranial aneurysms in five patients is discussed. The clinical findings are described in detail. (11 figures, 11 references)

Beulah Cushman.

Niebeling, H. G. **Ophthalmologic findings in opticochiasmatic arachnoiditis.** Klin. Monatsbl. f. Augenh. 129:161-169, 1956.

Sixteen patients are reported in whom the diagnosis was surgically verified. All of them had impaired vision at least in one eye. The loss of vision may be rapid and early diagnosis is mandatory. Eleven patients had papilledema or optic atrophy. Exophthalmus was present in eight patients and ophthalmoplegia in three. Only one patient had a normal visual field. Most of the patients had a concentric constriction. (5 figures, 2 references)

Frederick C. Blodi.

Parigi, S. and Nuti, C. A. **Cardiovascular reflexes from retinal stimulation in mental patients.** Gior. ital. oftal. 9:242-255, Jan.-Feb., 1956.

A study was made of the cardiovascular reflexes from retinal stimulation by light in 73 mental patients. Variations in blood pressure and in the frequency and amplitude of the pulse were noted. Changes were most marked in those suffering from depressive states, and least in schizophrenics. The authors suggest that the difference in vascular reaction depended on the difference in reaction of the optic-thalamic paths to the diencephalon in different patients. (3 tables, 6 references)

V. Tabone.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
411 Oak Street, Cincinnati 19, Ohio

News items should reach the editor by the 12th of the month. For adequate publicity, notices of postgraduate courses and meetings should be received three months in advance.

Announcements

Stanford postgraduate conference

Stanford University School of Medicine will present the annual postgraduate conference in ophthalmology from March 18 through March 22, 1957. Registration will be open to physicians who limit their practice to the treatment of diseases of the eye; or eye, ear, nose, and throat. In order to allow free discussion by members of the conference, registration will be limited to 30 physicians.

Instructors will be Dr. David L. Bassett, Dr. Jerome W. Bettman, Dr. Max Fine, Dr. Earle H. McBain, Dr. Arthur J. Jampolsky, and Dr. Dohrmann K. Pischel.

Programs and further information may be obtained from:

Office of the Dean
Stanford University School of Medicine
2398 Sacramento Street
San Francisco 15, California.

Certificate in ophthalmic surgery

The present certificate of the American Board of Ophthalmology gives no indication of a diplomate's surgical ability. It merely indicates that he is familiar with the principles of surgery. This has been necessary because of the fact that many outstanding ophthalmologists do not perform surgery. In addition, in some instances the diplomate has received excellent training in ophthalmology but with little opportunity to develop surgery.

It is for this reason that the board has decided to set up an examination for certification in ophthalmic surgery.

The preliminary requirements and the plan of examination follow:

Preliminary requirements

1. Possession of a certificate of the American Board of Ophthalmology for a minimum period of three years.

2. Ethical standards complying with the principles of ethics of the American Medical Association and the candidate's county or local medical society.

3. The candidate shall submit a certified list of 200 major operations; this to include 90 cataract operations, 46 muscle operations, 24 glaucoma operations, and 40 major operations to include retinal detachment, diseases of the lacrimal apparatus, traumatic surgery, and plastic reconstruction. All of the above operations are to have been performed after being certified in ophthalmology. In special instances the board may alter the specified number of the various listed operative procedures but without decreasing the total number of cases.

4. The candidate shall submit with his application 30 case reports of diversified major surgery that he has performed since certification by the board. These case reports are to include 15 cataract operations, six muscle operations, three glaucoma operations, and six additional major procedures of various types. These case reports should include preoperative work-up and notes, a certified copy of the hospital record; postoperative notes, a certified copy of the pathology report if present. All data submitted are to be double-spaced typing and the case reports are to be in duplicate.

5. All faculty members who have practiced for 20 years and who perform surgery and who have professorial rank in ophthalmology in Grade A medical schools shall be invited to take the written examination, and upon passing the examination and upon payment of the fee shall be issued the certificate in ophthalmic surgery.

Case histories will not be required in this group. This regulation is to be in effect for a period of three years following the adoption of these regulations.

6. Candidates who have completed their training in an approved residency shall present to the board a statement from the candidate's supervising surgeon, or surgeons, during his training time, vouching for the candidate's integrity, surgical judgment, and technical skill as shown during his training period. In the event that this is not possible, the candidate should present letters from three certified ophthalmic surgeons who are familiar with his work. These letters are to be sent directly to the secretary of the board.

7. Candidates who have not had a recognized residency but who present evidence of otherwise meeting the requirements may be admitted to examination upon the board's receiving a satisfactory letter from the candidate's preceptor, who must be a certified ophthalmic surgeon.

8. Letters are to be requested by the secretary from three certified ophthalmic surgeons who reside in the candidate's community, or vicinity, stating the candidate's surgical ability, judgment, and integrity as observed by them. These letters are to be sent directly to the secretary of the board.

These letters may be from certified ophthalmologists as well as ophthalmic surgeons until the list of ophthalmic surgeons is adequate.

Examination

Upon fulfillment of the above requirements, the candidate would be eligible for examination, which is divided into two parts:

1. *Written Examination*

This will be a comprehensive written examination covering: (a) surgical principles; (b) anesthesia, both local and general, together with knowledge of the care of complications arising from anesthesia; (c) indications for surgery; (d) preoperative and postoperative care; and (e) surgical complications and their care.

2. *Practical Examination*

(a) One part of the examination shall consist of the candidate observing patients with surgical conditions, followed by discussion and quizzing in the diagnosis, management, procedure, and possible complications immediately postoperatively and at a later period. This is to the based on the patients examined.

(b) Another part of the examination is to consist of a discussion and quiz based on the candidate's list of surgical case reports of patients operated upon since his certification.

Fee

A fee of $150.00 is payable with the application and will not be returnable if the candidate fails in the written examination. The fee for re-examination is to be $100.00.

Certification

Upon completion of the examination the candidate will receive a certificate from the American Board of Ophthalmology stating that he has successfully passed the examination in ophthalmic surgery.

In order to establish the examination, it is necessary that a group of certified ophthalmic surgeons be established. To accomplish this a special committee has been set up composed of former board members interested in surgery. This group, which includes some of our most outstanding ophthalmic surgeons, will be certified without examination. This special committee is to give the examination to those active board members desiring surgical certification. The examination is to consist of a written examination. These examination papers will be anonymous, being identified by a number known only to the registrar of the board.

In this manner the board will set up a sufficient number of certified ophthalmic surgeons to start conducting the examination.

Plans for the organization of the examination are now under way, and it is hoped that the first examination can be given in January, 1958, at the time of the written examination given for regular certification by the board.

Merrill J. King, *secretary*.

HARVARD BASIC SCIENCE COURSE

The Harvard Medical School announces courses for graduates in basic sciences in ophthalmology, beginning September 23, 1957, and continuing through January 16, 1958. The courses and instructors are:

Anatomy, Russell LeG. Carpenter, Ph.D.; biochemistry and histochemistry, Jin H. Kinoshita, M.D., David G. Cogan, M.D., and associates; microbiology and aseptic technique, Henry F. Allen, M.D.; neuro-anatomy, David D. Donaldson, M.D.; neuro-ophthalmology, Richard B. Pippitt, M.D., and associates; pathology and histopathology, Taylor R. Smith, M.D., David G. Cogan, M.D., and associates; physiology and toxicology, Alfred W. Scott, M.D., W. Morton Grant, M.D., Endre A. Balazs, M.D., and George Wald, Ph.D.; visual optics and physiology, Paul Boeder, Ph.D.

From January 17, 1958, to March 7, 1958, a course in the introduction to clinical ophthalmology will be given. Offered will be:

Refraction, Albert E. Sloane, M.D.; ocular motility, Abraham Pollen, M.D.; strabismus, Virgil G. Casten, M.D.; biomicroscopy, William P. Beetham, M.D.; glaucoma, Robert R. Trotter, M.D., Paul A. Chandler, M.D., and W. Morton Grant, M.D.; retinal detachment and indirect ophthalmoscopy, Charles L. Schepens, M.D., Robert J. Brockhurst, M.D., and associates; uveitis, plastic surgery, cataract, and miscellaneous topics, staff members.

For further information, write to:
Assistant Dean
Harvard Medical School
Courses for Graduates
25 Shattuck Street
Boston 15, Massachusetts

XVIII INTERNATIONAL CONGRESS

The XVIII International Congress of Ophthalmology will be held in Brussels, Belgium, from September 8 through 12, 1958, just 101 years after the first congress was held there in 1857. Prof. Léon Coppez is president of the congress. The main subjects chosen by the International Council are:

1. Orthoptic treatment of concomitant strabismus, presented by Dr. A. Bangerter, St. Gallen, Dr. T. E. Lyle, London, and Prof. J. Malbran, Buenos Aires.

2. Geriatrics in ophthalmology, presented by Prof. M. Buerger, Leipzig, Prof. J. François, Ghent, Prof. G. Jayle, Marseille, and Prof. M. Jayle, Paris.

Symposia will be organized for discussion of cataract, radioactive isotopes in ophthalmology, electroretinography, and glaucoma. Sessions will be reserved for free communications.

The International Association for Prevention of Blindness and the International Organization Against Trachoma will hold meetings during the Congress. All ophthalmologists are cordially invited to attend and it is hoped that a great number will come to Belgium where that same year a great Universal International Exhibition will take place.

For further information write to:
Prof. Jules François
General Secretary
15, Place de Smet de Naeyer
Gand, Belgium

Cincinnati centennial

The Academy of Medicine of Cincinnati announces its 100th Birthday Party, February 27 through March 5, 1957. In order to observe the occasion officially, a Health Museum and Exposition will be established in Cincinnati's spacious and historic Music Hall. One hundred and seventy-five health and scientific exhibits, representing medicine, hospitals, research centers, public health, nursing, pharmacy, and industry will be displayed in the north and south halls. Notable among these exhibits, and occupying some 4,000 square feet of space, will be an atomic energy exhibit from the American Museum of Atomic Energy entitled "Atoms for Peace."

The centennial convocation will be held on the last night of the exposition, March 5, 1957. The convocation address will be given by Sir Edward Appleton, Nobel Laureate, Edinburgh, Scotland, and civic leaders, officials of both the American and state medical associations, and government dignitaries will take part in the elaborate ceremonies.

Foundation for eye care

A National Medical Foundation for Eye Care, a nonprofit scientific and educational institution, incorporated in New Jersey, has been organized by ophthalmologists of the country to provide American ophthalmology with an agency to present to the public and to fellow physicians pertinent information on the care and treatment of the eyes.

Dr. Ralph O. Rychener, Memphis, is president of the foundation; Dr. Edwin Forbes Tait, Norristown, Pennsylvania, vice-president; and Dr. Charles E. Jaeckle, East Orange, New Jersey, secretary-treasurer.

Members of the board of trustees, in addition to the officers, are Dr. Alson E. Braley, Iowa City, Iowa; Dr. Frederick C. Cordes, San Francisco; Dr. Paul Chandler, Boston; Dr. J. Spencer Dryden, Washington, D.C.; Dr. Harold F. Falls, Ann Arbor; Dr. Everett L. Goar, Houston; Dr. Erling W. Hansen, Minneapolis; Dr. A. D. Ruedemann, Detroit; Dr. Barnet R. Sakler, Cincinnati, and Dr. Derrick Vail, Chicago.

In a special statement announcing the foundation's establishment, Dr. Rychener declared: "American ophthalmologists have long recognized an urgent need for an organization whose principal function will be to interpret the basic professional and scientific standards of good eye care for the American people, both to our fellow physicians and to the people whom we serve.

"The National Medical Foundation for Eye Care will seek to serve the public interest by helping the people to understand the educational qualifications and the professional functions of physicians specializing in ophthalmology, and the functions of related technical and ancillary personnel who assist them. The foundation will also endeavor to keep our colleagues in the medical profession informed concerning the problems confronting ophthalmology in its efforts to fulfill its mission as a member of the team of recognized medical specialties serving the American people."

Dr. Rychener revealed that the foundation is now enrolling its charter membership, and he invited all ophthalmologists and other physicians interested in eye care to become charter members of the foundation.

Applications are available through Dr. Charles E. Jaeckle, secretary-treasurer, at 136 Evergreen Place, East Orange, New Jersey. The foundation will establish an administrative office in New York City about January 1, 1957, and will also make available an affiliate membership for persons other than doctors of medicine who are interested in aiding the purposes of the foundation, Dr. Rychener announced.

The object and purpose of the foundation is to advance the public welfare by:

1. Gathering, receiving, assembling, and studying information relative to eye care.

2. Fostering and/or engaging in investigations and research in all aspects of eye care.

3. Sponsoring studies of education, socio-economic, and scientific factors affecting eye care.

4. Issuing reports and otherwise disseminating information relative to eye care to the general public and to members of the medical profession and ancillary workers.

5. Promoting the conservation of vision and the prevention of blindness through the wider dissemination of knowledge of the eye, it defects, disfunctions, and other diseases, and their relation to general health.

6. Promoting a more effective utilization of the scientific knowledge of ophthalmology and the other related branches of medicine.

7. Generally performing any act, related to the foregoing, designed to present to the public generally, and the medical profession, all pertinent information on the care and treatment of the eyes.

Grants for eye research

The National Society for the Prevention of Blindness has announced recent grants totaling $26,500 for 10 eye research projects. According to Dr. Franklin M. Foote, executive director, the awards are:

Dr. Arnall Patz, Baltimore, $5,000, retrolental fibroplasia.

New York Eye and Ear Infirmary, $2,000, electrophysiology of the eye.

University of Nebraska Medical School, Omaha, $4,000, adrenocorticoid function in relation to diabetic retinitis.

Wills Eye Hospital, Philadelphia, $3,000, choroidal circulation.

New York University-Bellevue Post-Graduate Medical School, $2,000, pancreatic dornase in inflammatory ocular exudates.

Washington University School of Medicine, St. Louis, $2,500, photocoagulation of the retina.

Albert Einstein College of Medicine, New York, $1,000, fields of vision studies.

Medical College of Georgia, Augusta, $2,000, bacteriology of uveitis.

University of Chicago, Department of Pharmacology, $2,500, synthesis of carbon^{14} and sulphur^{35} radioactively labelled Diamox.

Beth Israel Hospital and Massachusetts Eye and Ear Infirmary, Boston, $1,500, development of effective apparatus to test vision in early infancy by means of opticokinetic response.

The National Society's grant for continuing studies in retrolental fibroplasia is part of a $15,000 fund established in 1953 by the E. Matilda Ziegler Foundation.

The nation's leading nonprofit sight conservation agency, the Prevention of Blindness Society carries on a year-round program of research, service, and education. The organization is supported by voluntary contributions to its headquarters at 1790 Broadway, New York 19, New York.

Orthoptics course

The basic course in orthoptics for technicians, sponsored by the American Orthoptic Council, will be held at the Department of Ophthalmology, University Hospitals, Iowa City, Iowa, from June 19 through August 10, 1957. As usual, there will be didactic lectures and practical demonstrations, given by an outstanding faculty. For further information write to:

Dr. Hermann M. Burian, Department of Ophthalmology, University Hospitals, Iowa City, Iowa.

Societies

British Columbia conference

The British Columbia Oto-Ophthalmological Conference will be held in Vancouver, B.C., on May 23 and 24, 1957. Guest speakers will be Dr. Alson Callahan, Birmingham, Alabama, and Sir Victor Negus, London, England. Members of neighboring eye, ear, nose, and throat societies are cordially invited to attend the conference.

Nassau meeting

Dr. A. Edward Maumenee, Baltimore, recently spoke to the Nassau (County, New York) Ophthalmological Society on "Treatment of conjunctival corneal lesions."

Irish society annual meeting

The Society of British Neurological Surgeons has accepted the invitation of the Irish Ophthalmological Society to a combined meeting of both societies to be held in Dublin on May 16, 17, and 18, 1957.

Dr. Frank Walsh (Baltimore) is delivering the Montgomery Lecture on "third nerve regeneration: Clinical evaluation." A symposium on the "blood supply of the chiasma and optic nerves" has as openers Prof. François (Ghent) Prof. Erskine (T.C.D.) and Prof. Brodie Hughes (Birmingham). Dr. Max Chamlin (New York) is speaking on "Visual function in X-ray treatment of pituitary tumors."

The council of the Irish Ophthalmological Society extends a cordial welcome to any wishing to attend this combined meeting. The registration fee is half a guinea. Please notify the secretary at the earliest possible date so that inviations, which are limited, can be issued. Address: Dr. L. B. Somerville-Large 2, Fitzwilliam Place, Dublin, Ireland.

Personals

Dr. George S. Crampton, emeritus professor of ophthalmology at the Graduate School of Medicine, University of Pennsylvania, has received the 1956 gold medal award of the Illuminating Engineering Society.

Dr. D. N. Maurice of the Institute of Ophthalmology, London, has been granted the second Sir William Lister award in ophthalmology.

Lieut. Col. Mohammad Wonojudo, an eye specialist in the Indonesian Army, was a recent visitor of the Ophthalmology Service, Walter Reed Army Hospital, Washington, D.C.

At Atlantic City, on November 15th, seven scientists and two health groups were presented with the 1956 Lasker Awards of the American Public Health Association. Ranked among the nation's highest medical honors, the awards were conferred at the association's 84th annual meeting by Dr. Gaylord W. Anderson, chairman of the Lasker Awards Committee and director of the School of Public Health, University of Minnesota.

It is very pleasing to report that among the recipients were Dr. V. Everett Kinsey, assistant director of research, Kresge Eye Institute, Detroit, and Dr. Arnall Patz, Baltimore. Describing the prize-winning achievements, the Lasker Awards Committee noted:

Dr. Kinsey and Dr. Patz have pursued original, well-controlled studies on the cause and prevention of retrolental fibroplasia (blindness) in prematurely born babies. As a physician in private practice, Dr. Patz used his own resources to ascertain for the first time that "routine high oxygen levels" were the cause of blindness in many of these infants. Dr. Kinsey subsequently "co-ordinated an investigation involving 18 hospitals and 75 ophthalmologists and pediatricians which produced conclusive and definitive proof of the relation between high oxygen concentrations and this blinding condition."

Dr. Erling W. Hansen, professor of ophthalmology at the University of Minnesota Medical School, was honored at a testimonial dinner given by 82 of his colleagues at the Town and Country Club, Saint Paul, Minnesota, on September 19th. The event was in celebration of Dr. Hansen's election to the presidency of the American Academy of Ophthalmology and Otolaryngology.

PRESCRIPTION OPTICIANS

Urgent Request

The Uveitis Laboratory, University of California School of Medicine, San Francisco, is interested to obtain freshly enucleated eyes from patients with *all types of uveitis* and other endogenous inflammations. Attempts are being made to isolate etiologic agents from these eyes.

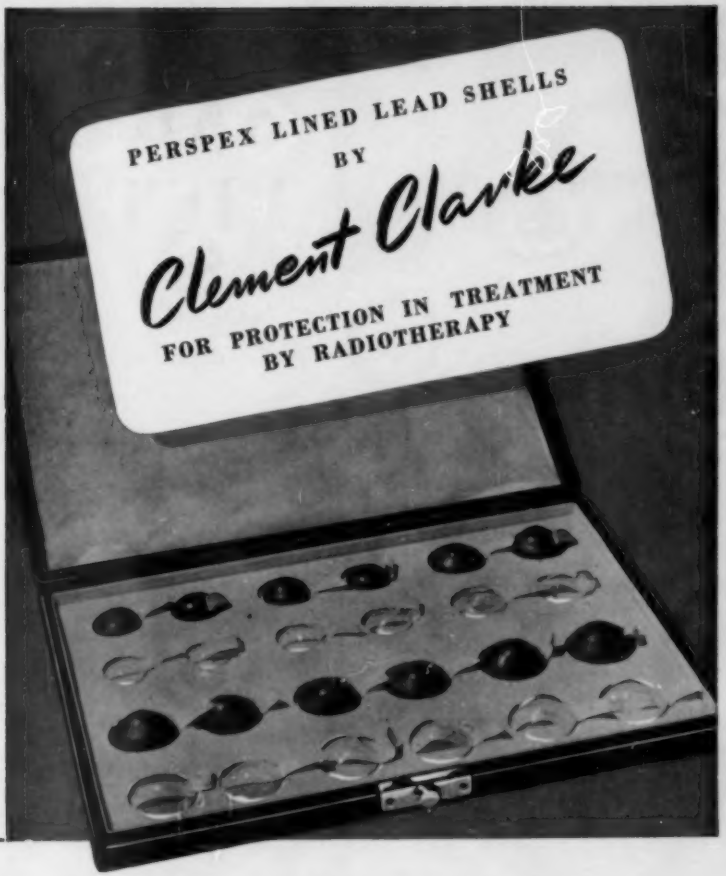
The eyes should *not* be fixed in preservatives or frozen, but placed in a sterile bottle, packaged, and shipped as quickly as possible. Please send specimens air express, special delivery, *collect*. Enclose history and findings and mark the package "Fresh Tissue Specimen—Rush."

A report of isolations of organisms and pathologic findings, including a slide, will be sent to the contributor. Credit will be given in any resulting publications if desired.

* * * *

Telegraph collect if specimen being sent. Send eyes to Samuel Kimura, M.D., Michael J. Hogan, M.D., or Phillips Thygeson, M.D., University of California School of Medicine, San Francisco 22.

Pat. No. 530108



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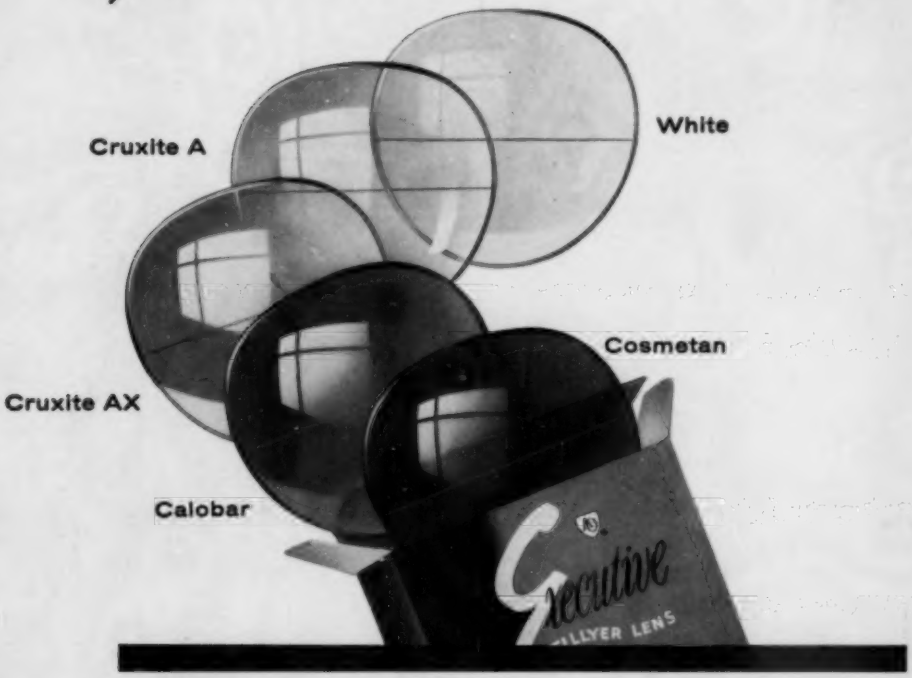

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